RAILROAD GAZETTE

FRIDAY, OCTOBER 19.

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Continuous Heating Before the New York Railroad Commissioners.

On the 26th of September the Railroad Commissioners of the State of New York issued a circular calling attention to the fact that the state law regulating the heating of steam passenger cars goes into effect on the 1st of November of this year, and asking representatives of the railroad companies of the state to meet with them at a public hearing to be held in Albany, Oct. 16. The purpose of this meeting was to promote, if possible, agreement on some form of a uniform steam coupler. This meeting was held as announced, and the following gentlemen were present, representing their various roads:

J. M. Toucey, General Superintendent New York Central & Hudson River.

Theo. Voorhees, Assistant Superintendent New York Central & Hudson River.

L. Packard, Master Car Builder New York Central & Hudson River.

John Adams, Superintendent Fitchburgh.

J. W. Marden, Master Car Builder Fitchburgh.

W. H. Fenner, Jr., Pullman Palace Car Co.

Samuel Porcher, Pennsylvania.

H. G. Young, General Manager Delaware & Hudson Canal Co.

R. C. Blackall, Superintendent Motive Power Delaware & Hudson Canal Co.

J. E. Shinn, Auditor New York & New England.

J. B. Kenney, Superintendent Motive Power New York & New England.

J. W. Cloud, Superintendent Motive Power Erie.

R. H. Wilbur, Assistant Superintendent Lehigh Valley.

H. S. Goodwin, General Superintendent Lehigh Valley.

J. I. Kinsey, Superintendent Motive Power Lehigh Valley.

J. E. Lentz, Master Car Builder Lehigh Valley.

H. M. Britton, General Manager Rome, Watertown & Ogdensburgh.

A. Dolbeer, Superintendent Motive Power Buffalo, Rochester & Pittsburgh.

Commissioner Rogers called the meeting to order and pointed out that the Railroad Commisssoners have under the law the discretion of extending the period for heating railroad trains by steam, not to exceed one year, and that a number of applications had been made to have the time extended. The roads making such application have pointed out the difficulty of determining upon a uniform coupler. He said that the board did not think that the law should be defeated by the failure upon the part of the railroad companies to agree upon a uniform coupler, inasmuch as there are a number of good ones available, and that it was with the object of seeing whether some uniformity of opinion could not be arrived at that the meeting was called.

Mr. H. G. Young, General Manager Delaware & Hudson Canal Co., said that his company had been experimenting with steam heating for over a year, and their experience, so far as it goes, has been very satisfactory. The company uses the McElroy system. They are anxious to secure the adoption of a uniform coupler, and he thought that the best way to meet this question was through the Railroad Commission; that if the Commission would recommend the adoption of any one coupler, his road was ready to comply with the recommendation.

Commissioner Rogers hoped that a conclusion would be arrived at without a recommendation from the board. First, because the board has no power to enforce such recommendation; and second, because it cannot judge as intelligently of the merits of a coupler as can the railroad.

Mr. Cloud, Superintendent of Motive Power, Erie, recalled the action of the committee of railroad officers who met last year for the purpose of choosing a coupler. This committee, as is known, agreed to recommend to their respective roads the McElroy coupler. The roads represented were the Lehigh Valley, the Delaware & Hudson Canal Co., the Reading and the Erie. He did not appreciate the force of the statement made by the Chairman of the Board of Commissioners that it is so very important that the railroads should agree upon a uniform coupler and use it. That is, it did not seem essential to him that any line of road which does not have cars running in the same train with other roads' cars should be governed by any other road in the choice of a coupler. Where a few cars are interchanged an intermediate piece could be used with but little expense and trouble. He did not think the point of uniformity therefore a very serious one.

The principal difficulty in his estimation has been that none of the companies knew from experience what was a good, durable coupler. During the last two years there has been a great improvement in couplers; and much has been done that is worthy of attention, but meantime railroads that have a very large equipment have not been justified in equipping their cars with couplers that might all have to be taken off within a short time. The policy of the Erie, therefore, has been to equip cars with train pipe and heating pipe, and they are now putting on couplers. They have probably not much more than 50 cars piped, but are getting the material forwarded as fast as possible. They had run two trains with the Martin coupler, but did not find it satisfactory. They had tried also the Gibbs coupler and had carefully watched the performances of the McElroy coupler on the Delaware & Hudson. From their observations of that coupler they acquiesced in the agreement made last spring to use it.

In answer to a question from Mr. Blackall, Mr. Cloud said that it was the opinion of the conference committee last winter that the desired flexibility in a coupler would be best obtained by the use of hose, but that he did not consider anybody bound by that action. It was simply an expression of opinion.

Mr. Blackall, Superintendent of Motive Power Delaware & Hudson, said that they had applied the McElroy coupler in the latter part of last December and the same hose and same couplings are in use to-day, not having had any repairs; they are as good to-day as they were the first day. They had no difficulty from the water of condensation freezing in the lowest part of the curves or from obstruction to the passage of steam. They used hot water circulation and also direct steam.

Mr. J. I. Kinsey, Master Mechanic Lehigh Valley, said that they had experimented last winter with a train, but the system was not satisfactory. They then equipped some cars with the McElroy and with the Martin, but that was so late in the season that the experience had not been conclusive. At the conference meeting before spoken of they had agreed, however, to use the McElroy coupler with whatever system of piping they might adopt, and they expect to stand by that arrangement. In reply to a question by Commissioner Rogers, he said that, substantially, it may be said that they had adopted the McElroy coupler.

Mr. John Adams, General Superintendent Fitchburg, said that the Fitchburg had equipped with the Sewall a year ago last February. Last winter they equipped a number of mail cars and had seven or eight trains running all winter—one of six cars running 50 miles. The system had operated very well; in fact, no complaints had come to him in regard to it during the whole winter. Usually of cold winter mornings he had 20 complaints about cold cars. They have, however, put off equipping their cars completely, thinking that some action will be taken about a uniform coupler, and that perhaps some better device will be got up than now exists. They have about 80 cars equipped with the Sewall system, besides all of their baggage cars. All of their passenger locomotives are ordered equipped. Over 50 of them are so at present, and all of them will be so for this winter's business.

With regard to the meeting in New York last May, called by the Wagner Co., at which the Martin coupler was adopted, Mr. Adams said that, although his company felt bound to do what it could to abide with the vote of the meeting, so far as interchange goes, still they have so many cars equipped with the Sewall and so much doubt as to the superiority of the Martin system that they concluded to keep on with the Sewall. They expect to have an intermediate coupler, which can be applied with little trouble, for interchange. If this does not work, they may have to change the hose. The Fitchburg would be very glad to see a uniform coupler adopted, but Mr. Adams thinks that this winter a great many things will be learned that are not at present known, and by next spring we shall be better qualified than now to say what is the best coupler in the market. He thinks the companies should not be in haste to adopt an inferior one.

Even if a uniform coupler were adopted to-day he does not see how it would be possible to have it ready and applied before November. As to the durability of hose, he said that hose which was put on a year ago last February, and had run two seasons, is still in service, and he does not think that any trouble may be anticipated with a flexible hose.

Mr. J. M. Toucey, General Superintendent New York Central & Hudson River, said that his company had recognized the necessity after the White River accident of heating cars by steam. Some eight years ago they attempted the same thing, and equipped five local trains. They used the flexible hose, had experienced much difficulty from it, and therefore on resuming their experiments later they looked about for a metallic coupler. They found the Martin had been in use on one of their branches, the Dunkirk, Allegheny Valley & Pittsburg, for some time; found it satisfactory, purchased it, began equipping their cars with it, and have now their entire equipment ready. The Boston & Albany also has done practically the same thing, and Mr. Toucey does not see how they can make any change. The Martin is satisfactory, and does its work with less pressure from the locomotive than can any coupler that sags between the cars. The Boston & Albany, New York Central, Lake Shore, C., C., C. & I. and Michigan Central are all agreed to use the Martin.

One objection mentioned to the flexible hose was the condensation in the sag, and Mr. Blackall reminded him that the McElroy coupler does not sag, but is held horizontal by a wire rope.

Mr. Young said that his company interchanges cars with five different roads, and he should expect great embarrassment in making arrangements to couple with five different couplers.

Mr. Toucey said further that the Martin has a flexible hose that can be coupled with a straight coupler.

In reply to a question Mr. Toucey repeated that all of their cars, substantially, except a few mail cars, are now equipped with the Martin.

At the request of Commissioner Rogers Mr. Gold showed one of his couplers which couples with the Martin.

Mr. J. A. Shinn, New York & New England, said there appears to be a wide difference between those who think that the flexible hose coupling has proved a failure and those who think that the straight metallic coupling has proved a failure, and until they have had more experience, and are able to decide this question, it would be a hard matter to bring them together. If one is adopted now on the recommendation of the board, there may shortly be considerable expense and loss of time in changing again to the other. His road experimented last winter with three different couplers, one of which, the Sewall, was reasonably satisfactory, but not perfectly so. They were not ready to say that it was the best that could be had, and therefore equipped about 50 cars with the Westinghouse air-brake coupler, which they found reasonably effective, and thought would answer the purpose until more experience was gained, and until inventors have a chance to devise something other than has yet been presented. The air brake coupler is cheap, well known to trainmen, and reasonably effective.

They had no trouble, either with that connection or with the Sewall, from water freezing in sags. The hose had endured a year and a half, and they are putting steam through it again this year. This Westinghouse coupler costs $6 per car, and while Mr. Shinn does not think that it will be the steam-heating coupler of the future, he does think that it will answer very well until the best is devised. He does not think that the couplers yet offered represent the genius of the American inventors. With regard to interchange, a compromise could be made, or an intermediate piece carrying one end of each coupler could be used. They used about 25 lbs. steam pressure with the Westinghouse coupler; he had seen 80 lbs. on at times. They are equipping their engines with the reducing valve, and would not expect to use more than 25 or 30 lbs. pressure in the train pipe.

Mr. Toucey said it was the Westinghouse coupler that they experimented with eight years ago; that the hose disintegrated very rapidly under steam.

In reply to a question by Commissioner Baker Mr. Toucey said that, so far as the New York Central was concerned, it is not essential that a uniform coupler should be adopted to carry the law into effect; but the Central may have to take the position it did in regard to the air-brake, and say "we will not interchange with you unless you put on our coupler."

Mr. Samuel Porcher, Northern Central Railroad, said that his company in such matters depends upon the Pennsylvania, which company has not gone far enough to decide on any system of heating. He thought that the difficulty of interchange would ordinarily be got over by the use of an intermediate piece. The Pennsylvania considers the question of ventilation and regulation of the temperature in the cars a very important one. That company is endeavoring to perfect a return system, taking the water of condensation back to the tender.

Mr. J. W. Marden, Superintendent Car Department Fitchburg, agreed perfectly with Mr. Shinn and one or two others that the couplers are yet in an experimental stage, and if roads are obliged to adopt one particular coupler now they would be shut off from further experimenting, and would not get the most economical and best coupler. He had talked with a great many members of the Master Car-Builders' Association, and has no doubt that they are all ready and willing to adopt a uniform steam coupler so soon as that coupler is presented to them in a way that will convince them that it is economically the best to be had. The Sewall is perfectly satisfactory to the Fitchburg. He has made an intermediate coupler with the Martin on one end and the Sewall on the other, to be used in interchanging.

Mr. A. Dolbeer, Superintendent Motive Power Buffalo, Rochester & Pittsburgh, said that they have two trains equipped with the Martin. It seems to him that the question must be decided between the metallic coupling and the flexible hose. On his road, which has a great many curves, the metallic coupler is a failure. In ordering new couplers they will try a new joint introduced by the Martin people, but he is not sanguine of its success.

Mr. W. H. Fenner, Pullman Palace Car Co., said that while the Pullman Company think well of the Sewall coupler, they have not adopted any. They are not in position to adopt a coupler before the roads over which their cars run have decided what they will do. They will have to be governed by the roads. They are trying several methods of steam heating, but they see, as do most of the railroads, that it is yet too early to adopt any one system.

Mr. Henry R. Towne, New York Safety Car Heating & Lighting Co., would call the attention of the board to two of his couplers. Last winter their equipment had been put on some thirty different roads, and their experience had not been satisfactory. The work had been done in haste and, perhaps, with insufficient care and knowledge. They have been engaged through the whole summer in developing and testing apparatus for steam heating of cars, and now have an excellent system. It has worked perfectly in laboratory tests. He thinks that what has been said at this meeting

about not adopting a uniform coupler is very sound. A model of the company's device was shown to the board.

Mr. J. R. Swayne, of the Barrett Lighting Co., showed a flexible hose coupler designed to take live steam from the locomotive.

Mr. McElroy showed a model of his apparatus and said that it was in use not only on the New York roads, which have been mentioned, but on the New York, Ontario & Western and the Pullman vestibuled train between New York & Chicago on the Pennsylvania road.

Mr. Gold, of the Gold Car Heating Co., explained his system of heating and his couplers. With his system a car would remain comfortably heated for 4 hours after steam was cut off.

Mr. McElroy, in answer to a question from Commissioner Rogers, said that in a temperature of 20 degrees above zero a car could be kept warm two or three hours by his system.

Mr. R. C. Pruyen gave the price of the McElroy coupler as $7.50.

Mr. Alphonse Coté showed his coupler, which is in use on the Staten Island Road, price $26 in brass or $22 in steel, and offered to put it on any car on trial free of cost.

Mr. Sewall, of the Sewall Car Heating Co., said that his company had been engaged in the business of heating cars by steam for a dozen years or more. They had begun their experiments with the Westinghouse coupler, but had discarded it. He exhibited his coupler and explained it. Practical experience has proved that little, if any, water stands in the coupler, and a coupler had remained connected on a car standing on the track, the thermometer 40 degrees below zero, and the amount of ice formed in the coupling was so small as to be ignored. This coupling, with hose, costs $7.

Mr. John Lentz, Master Car-Builder, Lehigh Valley, speaking for the Pennsylvania & New York Canal & Navigation Co., and the Geneva, Ithaca & Sayre, said that those roads will as quickly as possible equip with the McElroy.

Mr. J. C. Sturgeon showed a metallic coupler and a ball joint which has not yet been put into actual service.

Mr. J. I. Collins also showed a metallic coupler which cost $20 a car.

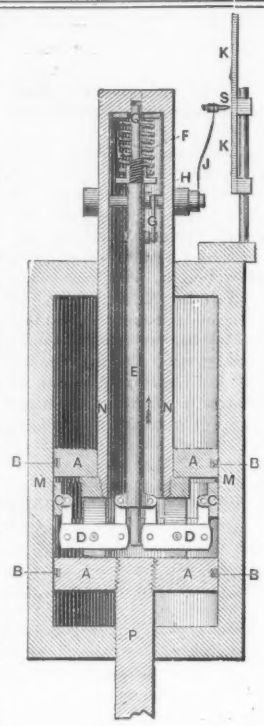


Fig. 1.

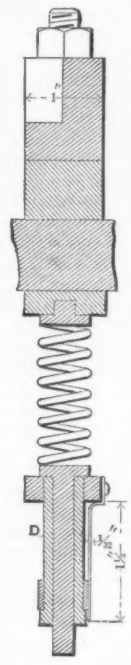


Fig. 2.

of the credits were all smaller items and charged out at small figures to be used on other engines.

DIMENSIONS.

Cylinders	18 × 24 in.
Boiler	54 in. (inside)
" wagon top, 8 in. rise.	
Drivers	56-in. centres
Fire-box	34 in. × 72 in. × 77 in. deep
Tubes (226)	2 in. diam. × 11 ft. long
Wheelbase, driving	8 ft. 6 in.
" total	22 ft. 6 in.
Tender	8 wheeled
Tank	3,600 gallons
Engine truck wheels	28 in. diam.
	Lbs.
Weight on drivers	63,300
" truck	33,250
Total weight	96,550

COST.

	Material.	Labor.	Total.
Cylinders, 5,800 lbs. rough weight at 3 cents	$174.00		
Driving wheels centres at 2 cents, tires at 5¼ cents	482.64		
Boiler and fire-box, new	636.08	$497.82	$1,133.90
Flues, new	377.75		
Tender tank, etc	515.15		
" trucks	240.00		
Unspecified	1,381.65	1,585.20	
	$3,807.27	$2,083.02	$5,890.29
Less value of old material not (used)	.....	.....	1,400.29
Net cost of engine	.....	.....	$4,490.00

Mr. Bent writes as follows: "The figures are undoubtedly low, but we are quite sure are correct. In the first place we buy our cylinder castings at a foundry where we keep our patterns and pay 3 cents per lb.

"All work in our shops is charged to repairs, and we claim that we get our labor as cheap (much of it being apprentice work), and as much work out of our men as it is possible to do. Our force is not so large but that the men can be closely watched, and they are put on their mettle to see how quickly and well they can get out their work. The foreman of boiler makers tries in each case to reduce the cost of labor on the preceding one.

"Considering the poor facilities we have for doing such work and the fact that most of the material in the engine is entirely new, we feel that we have made a most excellent showing, and you can make such use of the information in your paper as you see fit.

"I have often read with interest in your paper the work accomplished at other shops, and am not ashamed to have this compared with any similar work elsewhere. If you could see the shop where this work has to be done you would appreciate better the result. We are building new shops and when completed hope to make even a better showing than this.

"You will note that everything about the engine is new except the frames, links, yoke, guides, etc., but we had to reforge most of the frames, making as much work as though entirely new.

"The net cost of rebuilding No. 53 was $4,490 for labor and material, and the engine is just as good as an entirely new engine, for which we would have to pay any builder at least $9,000. You will notice there is very little old material in it.

"It handles our night passenger trains of 10 and 12 cars (4 or 5 sleepers) on a division of 190 miles in 6 hours, most of it on grades of 50 to 60 ft. per mile, and curvature of 4 to 6 degrees on the grades.

"I have given these figures to show that it costs less to rebuild an old engine than to scrap it and buy a new one in its place, besides we get an engine of greater capacity, the old engine in this case having been a 16 × 24, with 49 in. boiler, and smaller and lighter in every respect."

The steel for boiler and fire-box cost 4¼ cents; flange iron, 3½ cents; stay bolts, 3.6 cents, and rivets, 4.9 cents per pound. All the balance of iron used in boiler cost less than 2 cents per pound.

Mr. Bent claims that any railroad having shops of their own (which is usually the case with roads of any size), should, in addition to keeping up ordinary repairs be able to make such extensive repairs (amounting to rebuilding of engine) as shown on engine 53, and that in so doing they can obtain an engine at a cost much less than a

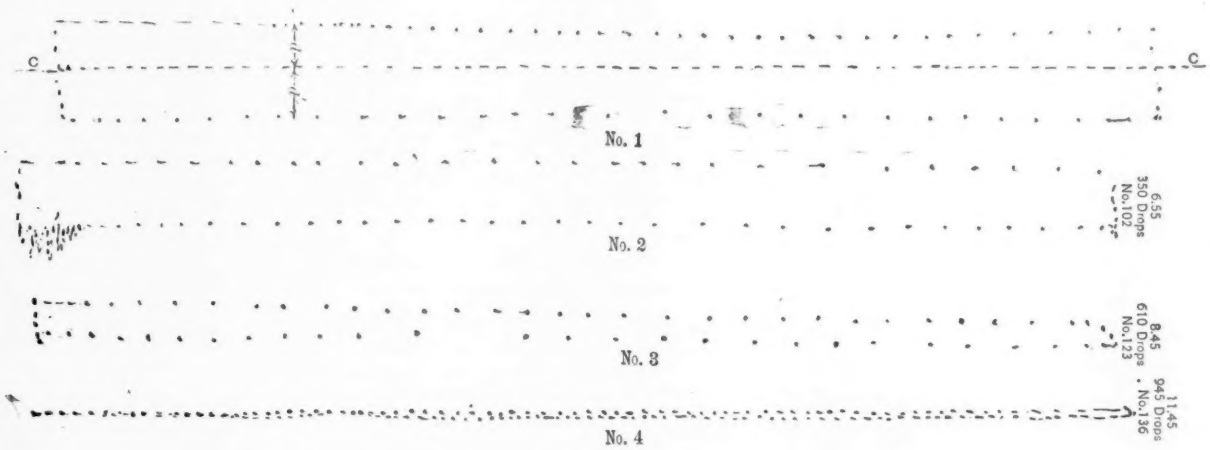


Fig. 3.

THE FRICTION OF PISTON PACKING RINGS IN STEAM CYLINDERS.

The Friction of Piston Packing Rings in Steam Cylinders.*

A measurement of such friction has been made with a measuring device which consists essentially of the following arrangement:

A cylinder *M* (fig. 1), 6 in. bore by 9 in. stroke, is fitted with a piston *A* long enough to permit a packing ring *C* one inch wide to occupy the position shown. The ordinary packing rings *B*, *B*, preventing the access of steam into the space† immediately surrounding *C*. The latter is supported on the outer ends of the levers *D*, *D*, which are pivoted at *O*, and have their inner ends coupled to the rod *E*. Motion is given to the piston *A* and its attachments through the piston rod *P*. Motion being in the direction of the arrow, the friction of the ring *C* tilts the levers *D*, thus compressing the spring *F*. The resulting movement of the rod *E*, relative to the incasing tube *N* gives motion to a pencil lever *J* through the pitman *G* and the crank *H*. Consequently the motion of the pencil *S* perpendicular to the plane of the paper is proportional to the amount of friction of the ring *C*.

The pencil makes a diagram resembling a rectangle upon paper fastened to a board *K*, *K*. The ring *C* is cut once and is provided with a device by the means of which its tension may be adjusted by a spring. Means are also provided whereby the ring may be drawn together so as not to touch the sides of the cylinder. When in the latter condition the spring *F*‡ is calibrated by loading the rod *E* at *Q* with known weights and noting the resulting movement of the pencil *S*.

Fac-similes of diagrams are given in Fig. 3. No. 1 is the friction at 65 lbs. tension per sq. in. upon the spring *C* (a boiler pressure of 67 lbs., revolutions from 36 to 115 and any cut off from $\frac{1}{10}$ to $\frac{3}{4}$), when the parts of the piston and cylinder are thoroughly devoid of lubricant through having been soaked in naphtha. The scale of the diagrams is 250 lbs. per in. of width each side of the centre line *C C*; that is, the distance *d* being about $\frac{2}{10}$ of an inch, the friction of the ring *C* is $\frac{2}{10} \times 250 =$ about 80 lbs., of force for the down stroke. Similarly the distance d^1 being about $\frac{2}{16}$ in., the total friction of the ring *C* on the opposite stroke is about 105 lbs. The total normal pressure between the ring *C* and cylinder *M* is $65 \times 6 \times 3.4416 = 1{,}226$ lbs. Therefore the coefficient of friction is about 7½ per cent.

Diagram No. 2 shows the friction for a feed of cylinder oil of one-half drop per minute* or one drop in two minutes. It gives a coefficient of friction of about 5 per cent.

Diagram No. 3 is for an oil feed of one drop per minute and shows an average co-efficient of about 3 per cent. Both diagrams, Nos. 2 and 3, afforded unsatisfactory lubrication, the piston groaning at the ends of the stroke when the engine was run slowly, and the film of oil found upon the interior surfaces was a sticky black paste, showing by chemical analysis about 50 per cent of iron.

Diagram No. 4 is for a feed of two drops per minute, and shows a co-efficient of about 1 per cent.

The oil upon the interior surfaces for this diagram indicated practically perfect lubrication, as it retained its natural color and was uncontaminated with iron. All of the diagrams were taken after the engine had been run at the respective feeds for about 8 hours.

* Paper read by James E. Denton at the Scranton meeting of the Society of Mechanical engineers, October, 1888.

† This space is kept drained of condensed steam.

‡ The spring actually resisting the motion of the levers *D* is the torsion of the pivots *O*. The spring *F* is merely shown as an illustration of spring action.

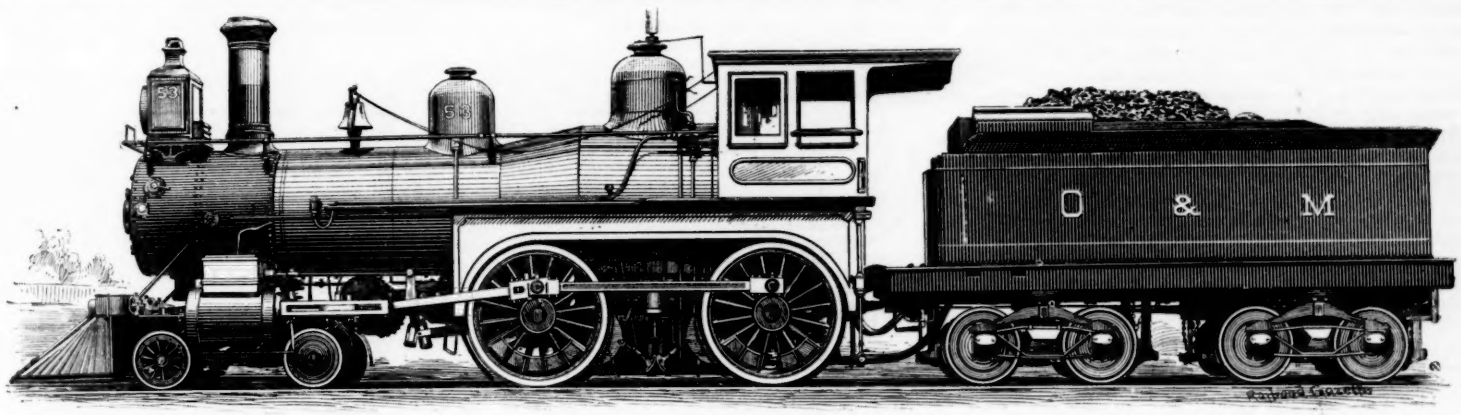
Locomotive, Ohio & Mississippi Railway.

The accompanying illustration represents a passenger locomotive which was rebuilt at the Ohio & Mississippi shops, Vincennes, Ind., in May, 1888.

It is claimed that the net cost of rebuilding this engine was only $4,500, though the boiler and fire-box, cylinders, wheels and tender were entirely new. Mr. C. C. T. Bent, the Superintendent of the road, sends us the inclosed brief resumé of the cost, and states that the gross cost of making a new engine out of an old one was $5,900 in even figures, and that the parts of the old engine not used were worth $1,400. This figure seems high, as the value of the material as "scrap" would be barely $600. The value was, however, ascertained as follows:

The value of the old boiler is manifestly the price it would bring for any other purpose for which it could be used, and it is therefore credited at $350, and will be used as a stationary boiler at a water station. A short time since a similar boiler was sold for stationary purposes for $375. The old tank is estimated to be worth $500 for use on another engine, simply being too small and rather old, and is credited at $500. The tires were only partly worn, but will be used on other engines, and are credited at $100. The cab was also good and was estimated to be worth $40. The balance

* The oil used was an average cylinder oil of good reputation, and 5,000 drops represented a pint.



LOCOMOTIVE, OHIO & MISSISSIPPI RAILWAY.

Rebuilt at the VINCENNES SHOPS, *May*, 1888.

builder would charge, which would be the profit asked by the builder and 20 per cent. charged for the use of shop, tools, etc. Railroad companies can buy their material as cheaply as makers of locomotives, and certainly can get as cheap labor, and it appears that in the amount of labor shown on the construction of engine 53, the labor is cheaper than the majority of shops and fully as efficient, while the engine is practically equal in all respects to an entirely new engine, for owing to the large amount of new material used, engine 53 is practically new.

This engine is class "J," standard passenger engine on divisions of heavy grades and standard freight engine on divisions of lighter grades.

The Mud Run Disaster.

The worst rear collision ever recorded in this country occurred at Mud Run, Pa., on the Lehigh Valley road, about 8 p. m., Wednesday, Oct. 10. A crowded excursion train was run into by a "double header" following, which crushed three cars and caused the death of over 60 passengers. On the day named there was a celebration at Hazleton, Pa., which drew together thousands of people, mostly Roman Catholics, from a large surrounding territory, and the Lehigh Valley road ran eight excursion trains from Wilkesbarre, via Penn Haven Junction. On the return at night the cars were crowded, and many of the passengers were, according to the reports, somewhat under the influence of liquor.

The station at the scene of the accident is at the end of double track, 10 miles north of Penn Haven Junction, and is on the right-hand side of the line as the colliding train was running; but the line approaching from the south (the direction the train came from) is on a sharp curve to the left, so that the best view was from the fireman's side of the engine. On the left of the train was the river, so that from the approaching engine there was a clear view of the station and the standing train from a point 1,450 ft. from the station and continuously thereafter. The grade is ascending about 57 ft. per mile. The distances south from the point of collision are: to siding switch, 154 ft.; to red light at station, 170 ft.; to position of flagman, 180 ft., and to the culvert mentioned in the testimony, 380 ft. The fireman of an approaching train 1,000 or 1,500 ft. distant would see the standing train at an angle so that an ordinary square bull's-eye tail light with green at the sides might show green as clearly as red.

The trains were ordered kept 10 minutes apart, which, according to reports, is double the usual interval on this road, the Superintendent issuing the following order:

Superintendent's Office,
WILKESBARRE, Oct. 10, 1888.

Conductors and engines of trains 3, 6, 12, 75, special passenger trains, helping engineers and operators:

You will observe the following instructions this day: If more than one section are run on the time of either of the above trains, they will keep ten minutes apart. Operators at telegraph offices will regulate the time. Should you be held for time by any operator, you will pull your train by his signal until your last car has passed the length of two rails, and wait until your time is up. Protect your rear. * * All trains will approach telegraph offices under full control. * * East-bound trains will take water at Wapwallopen and west-bound trains at White Haven. Engineer of helping engine to each train will send out one of their brakemen to protect the rear of train which he is pulling while taking water at both places, and the flagman must not be called in until the last car of the train has passed the tank. The brakeman to be left and picked up by the following train. Conductor of each train must see personally that the brakeman is sent out to protect him. A. MITCHELL, Superintendent.

The sixth excursion train, on arrival at Mud Run, 10 miles from Penn Haven towards Wilkesbarre (northward), found a stop signal, and pulled about 170 ft. beyond the station and stopped. The brakeman of this train, according to his own story, "immediately went back with red and white lights as far as the station." Another account says he claims to have gone to the culvert. The train had been standing about eight minutes when the collision occurred.

The seventh train had two engines, the foremost of which was a heavy freight engine with a steam brake, but having no brake connection with the second engine, which had the usual automatic air brake, connected with the train. It came on at probably 25 miles an hour and the foremost engine plowed its way for twenty feet or more into the rear car of the sixth train, and this car was driven half its length into the one ahead of it. It is said that there were 200 persons in these two cars, and that none in the rear car escaped injury and but few in the next one. The total number killed on the spot seems to have been 57, while those who have since died from their injuries bring the total dead up to 63 or more. (Accounts differ, some say 66.) The number injured is variously estimated at 25 to 50, one of these being a brakeman. Three employés were injured by jumping from the engines. Many passengers were badly scalded by steam from the locomotive. An attempt was made to pull the engine away from the car, but such action would apparently have caused more suffering that it would relieve, and was given up. The confusion and excitement was great and it was several hours before the injured received much relief. The wounded passengers were all taken away by 4 a. m.

The testimony published, most of which was taken before the Coroner, Dr. J. A. Horn, at Mauch Chunk, may be summarized as follows:

The engineer (Cook), who ran the foremost engine of the fifth section, worked from Tuesday at 11 a. m. to 2:15 a. m. of Wednesday. He was then off 4 hours and went on duty again, working to the time of the wreck—about 14 hours. The fireman and other men on the train had been on duty somewhat longer. What interval of rest they had had meanwhile is not stated, though it seems likely that they had had some time off, as is generally the case in running excursions. Both engineers assert that they did not feel sleepy. Each engineer had a brakeman to keep a lookout on the left side of the engine. One newspaper report hints that the trainmen had been treated to intoxicating liquors at Hazleton by their friends among the passengers, but no evidence is adduced. The station agent at Mud Run testified that all the trainmen were sober.

James Murphy, fireman of the second engine, testified that his engineer (Major) shut off steam before striking the curve, and sounded one long blast of the whistle, the regular signal for approaching a station. Murphy saw that the switch light and station train-order signal both showed white and so told the runner. According to the testimony of other witnesses, Major then sounded two whistles, indicating that he understood the "all-clear" signal. Murphy then got down from his seat to attend to the fire and John Mulhearn, brakeman, took his place. Murphy soon after heard the stop signal from the front engine and at once jumped off. He says he saw no red light at all, and, after the collision, went to the station and asked the operator, "Why did you not show the red signal?" The operator said, "We don't use the train-order signal for cases of this kind; but you were flagged."

John Mulhearn, the brakeman on Major's engine, as he mounted the firemen's seat, saw a small red light on the station platform, but there was a crowd around it and he "did not understand it." When the train had shot ahead a few hundred feet further witness saw the train ahead for the first time, and exclaimed: "Holy God! there is a section ahead of us." [This appears to have been said about 1,000 ft. from the preceding train.] "Major looked at me," proceeded the witness, "but said nothing. I do not know whether he heard me or not. Just as I cried out the red light was swung at us. * * In almost a second the crash came." Mulhearn testified that Cook continued using steam after Major had shut off.

Engineer Major testified that he could not see ahead very well on account of the steam and smoke from the engine in front, and therefore depended on the man on the other side of his engine. Cook (the forward engineer) continued using steam, Mulhearn was keeping a good lookout, and witness, therefore, felt satisfied. Major saw the red light on the station platform only after he had come up opposite to it. Upon being asked why he did not hold his train under control the witness said that as the engineer ahead was pulling he thought that the track must be clear, and he did not want to stop the train. Major had never run a passenger train before. Went on duty Monday at 9 p. m., and had had six hours' rest up to the time of the accident.

Hugh Gallagher, look-out man on the left side of Cook's (the foremost) engine, testified that he saw the red light when at a distance of about five telegraph poles from the station; but as it was merely a lantern and was stationary, he only watched it closely and said nothing. Very soon, however, it was waved and he then shouted excitedly to the runner to reverse his engine.

Fireman (or brakeman Pohl) of the forward engine, who jumped and received a broken leg, was seen by the Coroner at the hospital. He says he saw the white target (train order signal) and told the engineer all was clear.

Engineer Henry Cook, who has run a helping engine a year and a half and has fired 7 years on passenger trains on this division, testified that from Penn Haven Junction to the tunnel he ran at the rate of 22 or 24 miles an hour, and from there ran slower. "From the track I could see the Mud Run station, half a mile distant, but not from the engine; was running at the rate of 12 or 14 miles an hour when the station was in sight. I was sitting on the right-hand side of the cab. I was on the alert for signals, as is customary when nearing a station, but saw none. To see the station signal at the point where we should be able to see it it is necessary for me to climb the ratchet, which I did. I expected to see the order board white. There was a light in the station. While rounding the curve, Major, the engineer of 466 (who had charge of the train, my position being only as helper), blew two blasts for off brakes, which signified that everything was all right and that we should go ahead. We were a third of a mile from the station when I heard these two whistles. When within 150 ft. of the station and we were going at the rate of 10 miles an hour, I saw a white signal being swung on the station platform in the manner usually employed to stop trains when the lantern is used in switching at night; but much more violently. I at once whistled for brakes and applied my steam brake. This, though, extended no further than my engine. I again looked out for the cause of the signal, and saw the red signal lantern on the platform. I then reversed, but too late to avert the catastrophe. I understand that coming in under full control means so we can stop at the telegraph office. Could have stopped in time had Major checked the train coming around the curve. I knew we were going too fast. I am positive that Major pulled his throttle open a quarter of a mile below the station. [Doubtless when he was informed that the train order signal was white.—EDITOR.] I next saw a lot of people on the rear of the car we struck. I did not see any lights there. I was in the cab when we struck, and jumped out when steam was escaping. Had I had control of the air brakes I could have stopped the train. We left Penn Haven Junction at 7:36½ o'clock p. m., and the accident occurred about 8:02. The distance between these stations is 10 miles. The train wasn't under control at the rate we were running. I had been on duty for several days past, with but little sleep, although I felt fresh and wide awake. I had run a passenger train before. I believe if Major had applied the air brake he could have stopped the train. I had condensed steam in my brake pipes at the time, and consequently it did not do much good."

A. Mitchell, of Wilkesbarre, Superintendent of the Wyoming Division, stated that in addition to the special orders verbal instructions were given to some of the engineers to be careful. "I don't think that there is a man on our road who is afflicted with color blindness. All engineers are required to serve as firemen four or five years before they are given charge of a train. The proper signal would have been for the brakeman on the rear of section six to have gone back with a lantern and caps until he received a signal from the approaching train, and when the brakeman received this he was justified in returning to his train. When a train is run by two engines, both engineers are equally responsible. The second engine has control of the train. The conductor was responsible and should see that they went into a station under control. I was at my office when I received news of the accident, about 8:05 p. m. I left Wilkesbarre on an engine as soon as possible, but did not get to Mud Run until after 11 o'clock, on account of the many trains that were running. No one in authority refused to carry the Catholic priest from Wilkesbarre to the scene of the accident. I never suspected anything wrong with either Cook or Major."

Josiah Sandell, of Mauch Chunk, testified that he found the timber of the cars all sound, but the cars were not new. The car examined was No. 205 Central Railroad of New Jersey. There were eight lengthwise pine timbers in each car. Cross timbers were oak.

An interview with Assistant Superintendent R. H. Wilbur, published in the New York papers, indicates that the train order signal is usually used to hold trains the required interval apart, but station agent (or operator) J. W. Slocum testifies that this signal is used only for telegraphic orders. It seems certain that in this case the signal was left at "all clear" and a hand lantern used.

Concerning the three rear cars, which all belonged to the Central of New Jersey, we have the following statement from a trustworthy source:

"The cars were Nos. 204, 205 and 210. No. 205 had one end crushed in; Nos. 204 and 210 were telescoped. The cars seemed about alike. They were old cars but the timbers were all sound and good. They were built by W. C. Allison,

Philadelphia. The longitudinal floor timbers of No. 205 were of yellow pine, and eight in number, as follows: two centre sills, 3¼ × 6½ in.; four intermediate sills, two 3¼ × 6½ in., and two 3¼ × 5 in.; two outside sills, 5 × 7½ in. The two end sills, four transoms and two needlebeams were of white oak."

The previous notable rear collisions in recent years have been: Carlyon, N. Y., July 27, 1883, car blown out of siding to main track, 17 killed. Pittsburgh, Pa., Oct. 9, 1880, red tail light obscured by passengers standing on platform; 32 killed, 17 injured. May's Landing, N. J., Aug. 11, 1880, engineer ignorant of method of operating automatic brake, 28 killed, 47 injured. At Spuyten Duyvil, N. Y., Jan. 13, 1882, only 8 were killed, but the accident, from various circumstances, caused much discussion. The Jackson (Mich.) collision, that killed 15, was on Oct. 10, 1879, and that at Revere, Mass., which C. F. Adams says marked an era by the improvements following its teachings, occurred on Aug. 26, 1871, killing 29 and injuring 57. All but one of the great accidents of the past two years, Bradford, Mass.; Chatsworth, Ill.; St. Thomas, Ont.; Forest Hills, Mass.; White River, Vt., and Republic, O., have been of a different nature. That of Kouts, Ind., killing nine, was a rear collision. This, with St. Thomas (crossing) and Republic (butting), resulted from "negligence in operating" as the immediate cause.

EIGHT KILLED BY ANOTHER COLLISION.

On Tuesday of this week a work train collided with a freight which was running at high speed near Tamanend, Pa., on the Pottsville branch of the Lehigh Valley, not far from Mud Run. The particulars are not clearly given, and the exact cause of the collision cannot now be stated. The caboose of the gravel train was filled with Hungarian laborers. Six of these, with two trainmen, were killed, and twenty-four others were seriously injured.

Two women and one man in delicate health are reported to have died in the village of Pleasant Valley from the shock caused by hearing of the Mud Run catastrophe. Each had suffered the loss of relatives or near friends. Over 30 of the killed were from this village, and upwards of 20 belonged in Scranton.

Counterbalancing the Action of the Reciprocating Parts of a Locomotive.*

Experiments on the effect of different methods for counterbalancing the reciprocating parts and the horizontal throw of a locomotive and prevent nosing were made by three students, viz.: Edward H. Dewson, '85; George F. Reynolds, '86, and Edward M. Smith, '88, of the Massachusetts Institute of Technology. A model of an 8-wheel passenger locomotive, one-eighth scale, was suspended by four wires, one at each corner, and set in motion by steam. The dimensions of the locomotive being as follows:

Total wheel base	22 ft.	5¼ in.
Rigid wheel base	8 ft.	6 in.
Length of stroke		24 in.
Diameter of cylinder		17 in.
Diameter of boiler		52¼ in.
Length of tubes	11 ft.	0 in.
Diameter of drivers	5 ft.	3 in.
Diameter of truck wheels		30 in.
Distance of middle of cylinder from main drivers.	11 ft.	1½ in.
Weight on drivers		50,000 lbs.
Weight on truck		30,000 "
Weight, total		80,000 "
" piston, complete with rod		285 "
" cross-head with key		134 "
" main rod (entire)		305 "
" main rod, back end		196 "
" parallel rod		297 "
" main pin (before pressing in wheel)		68 "
" back pin (" ")		86 "
" crank pin boss (estimated)		71 "
" driving wheel (rough)		1,905 "
" " " " tire		1,330 "
" " " " boxes		227 "

The latter includes box, sponge box, saddle and brass. Ten per cent. of the last three weights should be deducted for finish, which will give

Weight of finished wheel	2,895 lbs.

From the weights of the locomotive on the drivers and truck, the centre of gravity of the entire machine is found to lie 9 ft. 7¼ in. back of the centre of the truck, and 1 ft. 6¼ in. forward of the centre of the main driving axle.

From these and other data an eighth scale model was constructed. Particular attention was paid to making all the parts, which affect in any way the disturbances of the reciprocating parts, exactly one-eighth scale. The changes made for convenience in construction could have no effect on the subject under discussion. The frame is made of a single piece of cast iron, to which the driving axle boxes are rigidly attached. The wheels are also made of one casting, and without spokes, with two circular slots, diametrically opposite each other, one to admit the fastening on of the counterweights, and the other to compensate for the loss of metal in cutting the first. The steam chests are placed inside instead of on top of the cylinders. The main rod was split, and the cross-head placed between the two parts, and the piston rod projects through the cross-head, and runs in a fixed bearing fastened to the frame. The model, as thus far described, weighs 74 lbs., whereas, in order to correspond to the weight of the locomotive, it should weigh 156 lbs. Hence a bar of iron weighing 82 lbs. was fastened to it in such a position that the forward end when supported at the centre of the truck should weigh 58.6 lbs., thus bringing the centre of gravity 14.41 in. from the centre of the truck and in the same relative position as in the full sized locomotive.

The following weights and dimensions of the model were used in calculating the counterweights:

Weight of crank pin	0.277 lbs.
" connecting rod	0.598 "
" piston, piston rod, etc	0.832 "
" total driving masses	1.707 "
" coupling masses	0.598 "
Length of connecting rod	10.953 in.
Distance of centre of gravity from forward end	7.07 "
Distance apart of cylinder axes	9.125 "
Distance apart of centre lines of parallel rods	10.25 "

The locomotive, if free to obey them, would receive five different motions through the action of the reciprocating parts:

1. Jerking, a forward and backward motion.
2. Nosing, an oscillation about a vertical axis through the centre of gravity.

* Paper read by Professor Gaetano Lanza before the American Society of Mechanical Engineers at the Scranton Meeting, 1888.

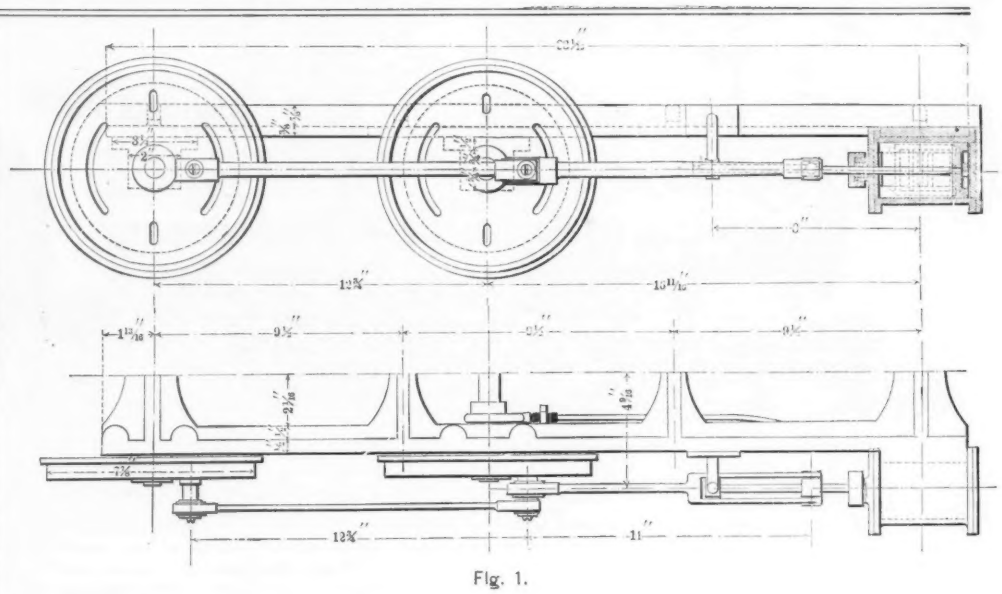


Fig. 1.

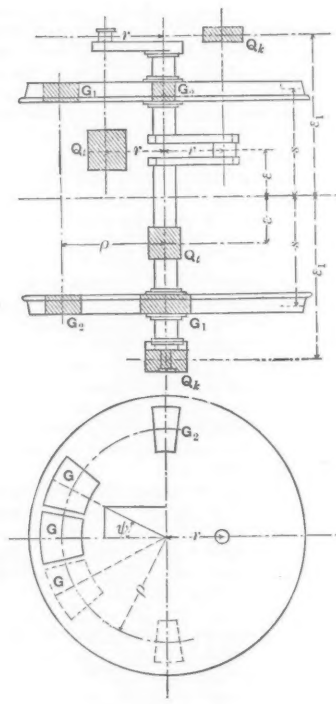


Fig. 3.

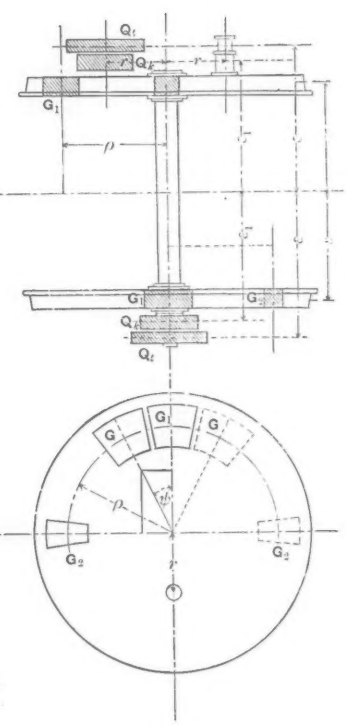


Fig. 2.

COUNTERBALANCING THE RECIPROCATING PARTS OF A LOCOMOTIVE.

3. Galloping, an oscillation about a horizontal axis at right angles to the track.
4. Pounding, a vertical up and down motion.
5. Rolling, an oscillation about a longitudinal axis.

Since the nosing and rolling are dependent upon the leverage of the acting forces, they are evidently greater for outside connected than for inside cylinder locomotives.

The counterweight is generally placed with its centre of gravity directly opposite the crank pin, and in the wheel, so that the centre of gravity of the reciprocating parts is not directly opposite the centre of gravity of the counterweights, but to one side, forming a set of equal and opposite parallel forces, or a statical couple, which tend to increase the nosing. The mean throw of the reciprocating parts at the dead points on one side of the locomotive can be balanced by two counterweights, a large one placed in the wheel on the same side of the locomotive, and opposite the crank pin, and a small one in the wheel on the opposite side of the locomotive which shall throw in the same direction as the reciprocating parts. This system of three parallel forces, if properly proportioned, will balance each other, and give a correct balance for the horizontal throw. Since we are using larger counterweights than the other method would require, the pounding and rolling would be somewhat increased. Since the cranks on opposite sides of a locomotive are at right angles to each other, we have, in each driver, one large and one small counterweight, which can be combined in a single resultant counterweight, the radius of whose centre of gravity makes a determined angle with the prolongation of the crank radius.

In order to balance the jerking and nosing at the same time, we can imagine exactly opposite the driving and coupling masses Q_t and Q_k, counterweights O_t and O_k of equal magnitudes, and at the same distance r from the axis, Figs. 2 and 3. The operation of these masses and counterweights balance each other. We can divide these counterweights into two parts, which come in the driving wheels according to their leverages, and which, together, are equal to the counterweight referred to (one of them is, however, positive and the other negative), and which exert the same turning moment about the axis. Change these weights so that they may have the same moment, and be at the required distance ρ from the axis, and we have thus obtained the proper counterweights.

Let $2s$ = distance apart of the cylinder axes, and of the imaginary counterweights.

$2s_1$ = distance apart of the centre of gravity of the corresponding coupling masses.

2 = distance apart of the tracks, or middle of the wheels.

G_1 = the counterweights which should come opposite the crank pin, and on the same side as the parts to be balanced, and G_2 = the weight which should come in the other wheel. ρ is the proper distance of the centre of gravity of the weights G_1 and G_2 from the axis, and r = the length of the crank. These imaginary counterweights cannot be placed in the positions referred to above, but must have their centres of gravity in the plane of the middle line of the wheel by applying the principle of leverages. The correct counterweights are thus expressed:

$$G_1 = \frac{r}{\rho}\left[O_t \frac{s+e}{2s} \pm O_k \frac{s+e_1}{2s} \right] \qquad (1)$$

$$G_2 = \frac{r}{\rho}\left[O_t \frac{s-e}{2s} \pm O_k \frac{e_1-s}{2s} \right] \qquad (2)$$

the upper signs referring to the case of outside cylinders (fig. 2), and the lower to inside cylinders, as seen in fig. 3. These equations give the total counterweights to be used, and these are to be divided between driving and coupled wheels.

Let G'_1 and G'_2 be the weights to be put in the driving wheel, and G_1'' and G_2'' those to be put in the coupled wheel.

$$\therefore\ G_1 = G_1' + G_1''$$

$$\text{and } G_2 = G_2' + G_2''$$

Let the coupling masses Q_k be considered as made up of R_k and C_k, the latter being the equivalent weight of the coupling crank concentrated at the crank pin, and the former the weight of the rod. Therefore:

$$G_1' = \frac{r}{\rho}\left\{ O\frac{s+}{2s} \pm \tfrac{1}{2} R_k \frac{e_1+s}{2s} \right\}$$

$$G_1'' = \pm\frac{r}{\rho}\left\{ \tfrac{1}{2} R_k + C_k \right\}\frac{e_1+s}{2s}$$

$$G_2' = \frac{r}{\rho}\left\{ O_t \frac{s-e}{2s} \tfrac{1}{2} \pm R_k \frac{e_1-s}{2s} \right\}$$

$$G_2'' = \frac{r}{\rho}\left\{ \tfrac{1}{2} R_k + C_k \right\}\frac{e_1-s}{2s}$$

Reducing to a single resultant by the parallelogram of forces:

$$G' = \sqrt{G_1'^2 + G_2'^2}$$

$$G'' = \sqrt{G_1''^2 + G_2''^2}$$

and if ψ_1 is the angle between the radius of G' and G_1'; and ψ is the angle between G'' and G_1'':

$$\text{tan. } \psi_1 = \frac{G_2'}{G_1'}$$

$$\text{tan. } \psi_2 = \frac{G_2''}{G_1''}$$

The different methods of counterbalancing experimented on were as follows:

a. No counterweights.

b. Method used by one locomotive works:

"For the main drivers place opposite the crank pin a weight equal to one-half the weight of the back end of the connecting rod plus one-half the weight of the front end of the connecting rod, piston, piston rod and cross-head. For balancing the coupled wheels place a weight opposite the crank pin equal to one-half the parallel rod plus one-half of the weights of the front end of the main rod, piston, piston rod and cross-head. The centres of gravity of the above weights must be at the same distance from the axles as the crank pin."

c. The rule given by D. K. Clark, and followed by another locomotive works:

"Find the separate revolving weights of crank pin boss, coupling rods and connecting rods for each wheel, also the reciprocating weight of the piston and appendages and one-half the connecting rod, divide the reciprocating weight equally between each wheel, and add the part so alloted to the revolving weight on each wheel; the sums thus obtained are the weights to be placed opposite the crank pin, and at the same distance from the axis. To find the counterweight to be used when the distance of its centre of gravity is known, multiply the above weight by the length of the crank in inches and divide by the given distance."

This rule differs from the preceding in that the same weight is placed in each wheel.

d. Method of counterbalancing already explained in this paper.

e. Method used by another locomotive works:

"S = one-half the stroke.

"G = distance from centre of wheel to centre of gravity in counterbalance.

"w = weight at crank pin to be balanced.

"W = weight in counterbalance.

"f = coefficient of friction so-called.

$$W = \frac{S \times \left(w - \frac{w}{f}\right)}{G}$$

$f = 5$ in ordinary practice.

"The reciprocating weight is found by adding together the weights of the piston, piston rod, cross-head, and one-half of the main rod. The revolving weight for the main wheel is found by adding together the weights of the crank pin hub, crank pin, one-half of the main rod, and one-half of each parallel rod connecting to this wheel; to this add the reciprocating weight divided by the number of wheels.

"The revolving weight for the remainder of the wheels is found in the same manner as for the main wheel, except one-half of the main rod is not added.

"The weight of the crank-pin hub and the counterbalance does not include the weight of the spokes, but of the metal inclosing them. This calculation is based for one cylinder and its corresponding wheels."

f. Method pursued by another works: "Ascertaining as nearly as possible the weights of crank pin, additional weight of wheel boss for the same, add side rod, and main connections, piston rod and head, with cross-head on one side; the sum of these multiplied by the distance in inches of the centre of the crank pin from the centre of the wheel, and divided by the distance from the centre of the wheel to the common centre of gravity of the counterweights is taken for the total counterweight for that side of the locomotive which is to be divided among the wheels on that side."

g. Method pursued by another locomotive works: "Balance the wheels of the locomotive with a weight equal to the weights of crank pin, crank-pin hub, main and parallel rods, brasses, etc., plus two-thirds of the weight of the reciprocating parts (cross-head, piston and rod and packing)."

h. Method pursued by another locomotive works: "Balance the weights of the revolving parts which are attached to each wheel with exactness, and divide equally two-thirds of the weights of the reciprocating parts between all the wheels. One-half of the main rod is computed as reciprocating, and the other as revolving weight."

EXPERIEENTS.

The method of making the experiments was as follows: To the front end of the model a long rod was attached, and, fastened in the end of this was a needle point, which was caused to trace its motion on a piece of smoked glass, slowly moved parallel to and at right angles to the longitudinal axis of the machine. A sinuous line was thus obtained which showed the jerking or nosing according to the direction in which the glass was moved. The amount was measured by a magnifying glass. The angle of nosing was calculated from the distance of the middle point from the centre of gravity of the machine. The following were the results with the different methods of counterweighting:

Jerking in inches.

Rev. per min.	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*
100	0.06	0.006	0.012	0.012	0.015	0.018	0.015	0.015
150	0.07	0.01	0.012	0.012	0.02	0.017	0.018	0.018
200	0.07	0.012	0.01	0.01	0.02	0.017	0.018	0.018
250	0.08	0.014	0.01	0.01	0.023	0.015	0.02	0.018
300	0.08	0.015	0.01	0.014	0.025	0.015	0.018	0.018

Nosing in Inches.

Rev. per min.	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*
100	0.20	0.01	0.01	0	0.04	0.028	0.04	0.038
150	0.18	0.01	0.01	0	0.035	0.030	0.035	0.035
200	0.16	0.015	0.012	0	0.033	0.030	0.032	0.033
250	0.15	0.015	0.015	0	0.03	0.030	0.030	0.030
300	0.12	0.017	0.015	0	0.03	0.032	0.030	0.028

Angle of Nosing in Minutes of Arc.

Rev. per min.	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*
100	36.30	1.81	1.81	0	7.24	5.07	7.24	6.88
150	32.67	1.81	1.81	0	6.33	5.43	6.33	6.33
200	29.40	2.71	2.17	0	5.97	5.43	5.99	5.97
250	27.21	2.71	2.71	0	5.43	5.43	5.43	5.43
300	21.78	3.07	2.71	0	5.43	5.94	5.43	5.07

REMARKS ON THE SPECIAL TESTS.

a. The pointer traveled in ellipses whose major axis was at right angles to the longitudinal axis of the machine, and whose minor axes moved from one side of the centre line to the other by a small amount. At high speeds there was a marked tendency to roll.

b. After making the experiments, with the results reported in the table, another set was made with a brake applied to the drivers, in order to determine whether the disturbances were affected or not by the loading or unloading of the drivers. The results, however, were identical with those obtained without the brake.

c. These tests were also repeated with the brake, but the results were identical with those obtained without the brake.

d. The results given in the table were obtained by using the single resultant counterweight, calculated as already explained. Afterwards the tests were repeated, using the two separate counterweights, as already described, in each wheel.

This method effectually destroys the nosing, but the counterweights are heavier, though later experiments showed that the pounding was not materially increased. A locomotive made at the Canadian Locomotive Works, Kingston, Ont., was so counterweighted, and ran very smoothly. The method is given by Rankine and Grove, but has been little used.

e. The counterweights used in this method of balancing are small, and the increased nosing and jerking shows that the counterweights are too light to balance the disturbances successfully, though the tendency to roll was considerably less.

POUNDING.

Two series of experiments were made to investigate these different methods of counterweighting in regard to their effect upon the pounding.

1. The model was placed upon a wooden frame so that the wheels were free to revolve, and the whole was placed upon platform scales. The whole was weighed at rest, and then after it was set in motion the weight was ascertained, which it was necessary to add to keep the scale arm from leaving its seat. The throw is the same upward as downward, and this extra weight subtracted from the original weight gives the amount indicated on the scale arm, when the arm just stays against the upper stop. These experiments do not show the actual force of the vertical throw in pounds, but give relative results showing which method is the best.

Rev. per min.	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*
100	..	1.5	1.25	1	1	1	1	1.5
150	..	2.5	2.75	1.75	1.5	2	1.75	2.5
200	..	4.25	4.25	2.75	2.5	3.75	3.25	3.75
250	..	6.75	6	4.5	4	4.75	5.50	5.25
300	..	8	7.5 to 9	6.5 to 7.5	5.75 to 6.5	6 to 7	6 to 7	7 to 8

These results show that the pounding is not materially greater in *d*.

CONCLUSIONS.

While method *d* effectually destroys the nosing, and is undoubtedly the best for balancing the horizontal throw, more experiments upon the vertical throw must be made before very decided conclusions can be drawn.

Quick Journeys and Fast Running—New England Railroad Club.

At the meeting of this club held Oct. 10, 1888, President Lauder occupied the chair, and announced as the subject for discussion for the evening, "Quick Journeys and Fast Running," which was opened by Mr. George Richards, lately Master Mechanic of the Boston & Providence, in a paper, of which an abstract follows:

The subject for consideration this evening is "Quick Journeys and Fast Running," two terms apparently synonomous, at first thought, but in reality they may express very different things; for quick journeys are oftener made by continuous running than by excessive high speed where frequent delays occur. It is easy to run at the rate of a mile a minute for a short time, but to continue that speed for 60, 80 or 100 miles is quite another thing.

The story of the fast-running train is a long story, but a few points may be noted, and some of the conditions which make fast trains possible may well be considered in the direction of safety, comfort and economy, though there is no reason to suppose that journeys, except in special cases, will be made much quicker than at present for a long time to come.

In an old book published many years ago we find the following passage. No doubt most of you here have seen the book: "The chariots shall rage in the streets; they shall jostle one against another in the broad way; they shall seem like torches. They shall run like the lightnings."

This verse has been interpreted as a prophesy of the coming of the locomotive, and indicative of the beginning of the end of all things earthly. A part of the prophesy is fulfilled every day; the latter part is not fulfilled. The modern chariots often jostle against one another in the broad way; but they do not run like the lightnings.

The locomotive has increased in weight in the last 30 years something over a hundred per cent., and this is going on at the rate of nearly a ton a year. It has not, however, increased much in efficiency for fast running.

Mr. Richards then gave accounts of recent fast runs, which have already been treated at length in the *Railroad Gazette*. The trains in the first three runs consisted of four eight-wheeled cars, weighing 170,000 lbs.

London to Crewe, 158 miles, 2 h. 46 m. The train was drawn by an old locomotive built in 1863, the weight of which was 30 tons, with 12.5 tons on the drivers. This engine was built after the old style, with one pair of large drivers, 7 ft. 6 in. in diameter, without any truck, with a short plain smoke-box, no netting or deflecting plates of any description to keep down sparks and dirt, with a plain open chimney free from any obstruction. Those engines were run clean. A hopper in the bottom of the smoke box is always open. Mr. Richards believed that the same arrangement on an American road would throw most of the coal, if fine, out through the chimney.

From Preston to Carlisle, with an ordinary four-coupled engine, 17 in. by 24 in. cylinders and 78 in. wheels, 90 miles was run in 90 minutes, covering a grade of 70 ft. per mile, 4.5 miles long. The train was considered too light for the Webb compound locomotives which haul the heavy trains. This machine has three cylinders, two outside, 14 by 24, and one inside, 30 by 24 in.; the outside ones are connected to the back wheels and the inside to the front. There are four driving wheels, 6 ft. in diameter. Unlike the American engine, the two pairs of driving wheels were not coupled together. The front of the locomotive is carried on one pair of large wheels with radial boxes. The engine weighs 95,200 lbs. and carries 33,600 lbs. on each pair of drivers. A locomotive of this class has drawn a train of 16 cars, 716,000 lbs., from London to Crewe, 158 miles, in 3 hours and 19 minutes, average 47.6 miles per hour, consuming 26.9 lbs. of coal per mile, equal to 88.3 miles per ton. The tender was mounted on three pairs of large wheels, with large axles and no trucks.

Carlisle to Edinburgh, locomotive designed by Mr. Drummond, having inside cylinders 18 × 26 in., with one pair of 7 ft. drivers and a four-wheel truck forward, with wheels 42 in. diameter, which decreased the chance of beating and general friction. They ran 101 miles in 104 minutes, and covered a grade of 66 ft. per mile for ten miles. Behind the driving wheels there is a pair of wheels that hold up part of the load. The total weight of the engine is 93,850 lbs., about the weight of a heavy American passenger locomotive; weight on the drivers 38,080 lbs. The tender holds 3,600 gallons of water and five tons of coal, and is mounted on three pairs of 48 in. wheels, and has no trucks. The axles are of Siemens steel, with 7-in. wheel fit, and journals 6 × 12 in.

East Coast Line, London to Edinburgh, 392.5 miles in 7 hours 27 minutes; actual time in motion, 6 hours and 47 minutes; average, 57.8 miles per hour. One run of 105.5 miles was made in 106 minutes. The cars weighed 270,000 lbs.

These speeds can be attained in England, not altogether from the power of the locomotive, but from the lightness of the train also, in comparison with the heavy drawing-room, express and baggage cars that are run in this country. Then the almost entire absence of grade crossings, the use of absolute block signals, the arrangement of tracks, switches, etc., around stations, and the excellent condition of the roadbed and track give opportunities for fast and continuous runs and quick journeys.

The fast train between Jersey City and Philadelphia performs the journey of 89.6 miles in 1 hour and 52 minutes; actual time in motion, 1 hour and 48 minutes; average speed, 49.7 miles per hour. The weight of the locomotive is 96,700 lbs.; tender, 56,300; six cars, 330,100; total weight of empty train, 483,100 lbs. The consumption of anthracite coal per mile is 55.58 lbs.; maximum grade, 35.8 ft. per mile.

The limited express between Portland and Bangor makes one stop, and performs the journey of 138.8 miles in 3 hours and 10 minutes; average speed, 45 miles per hour. The weight of the locomotive is 92,800 lbs.; tender, 65,400; cars (estimated), 212,800; total weight of empty train, 371,000. Coal consumed per mile, 40.3 lbs.

The private train known as the "Flying Dude" on the Old Colony road performs the journey from Boston to Wood's Holl, 72 miles, in 1 h. and 40 min., and makes 5 stops: actual time in motion, 1 h. and 30 min.; the average is 48 miles per hour. The weight of the locomotive and tender is 125,000 lbs.; three cars, 178,000; total, 303,000. Coal consumed per mile, 29.8 lbs. Maximum grade 40 feet per mile, and none over 3 miles long. The weight of these three cars is about the same as that of the four English cars above mentioned.

The Steamboat passenger train on the Old Colony Road performs the journey between Boston and Fall River, 50 miles, in 1 h. 20 min., making one stop; actual time in motion, 1 h. 18 min.; average miles per hour, 38.4. Weight of locomotive and tender, 157,000 lbs.; 12 cars, 674,000; total, 831,000. Coal per mile, 65.5 lbs. Maximum grade, 44 feet per mile, and 5 miles long.

The Shore Line Express, from Boston to Groton, performs the journey of 106 miles in 2 hours and 32 minutes; actual time in motion, 2 hours and 19 minutes; average miles per hour, 45.75. Weight of six cars, 344,000.

Forty years ago two regular trains from Boston on two different lines performed a journey of 44 miles in 1 hour and 15 minutes; actual time in motion, 1 hour and 8 minutes; average per hour, 38.82. Weight of cars, 175,000 lbs.

Other cases might be cited, but all tend in one direction, to show that for quick journeys certain conditions are necessary, and among them the following: that the weight and number of cars be as low as practicable; that the rolling stock be as free as possible of complications and of failing parts, and the general avoiding of all that interferes with a continuous high speed. It was only three weeks ago that some 20 odd persons were killed by the failing of a part of the locomotive, and that part not in use on English fast trains. On those engines which are so much lighter than ours, there is no breaking of coupling rods or crank pins. The danger is that on fast trains some device may be put in to accomplish something in one direction that will cause an accident in another.

As showing in a measure the effect of the weight of the train on the speed, we refer to the Scotch Express, reaching an average of 57.1 miles per hour, with a 30-ton locomotive drawing four cars, while a 95,000 lb. locomotive with 16 cars, run over the same track, averaged 47.6 miles, and a 38-ton locomotive with four cars made 60 miles per hour for 90 miles, covering a 70 ft. grade, 4.5 miles long. Again, the "Flying Dude" reached an average of 48 miles per hour with 178,000 lbs. of cars, and consumed 29.8 lbs. of coal per mile. The Steamboat train with 674,000 lbs. of cars reached an average of 38.4 miles per hour, and consumed 65.5 lbs. of coal per mile.

There is but little difference in the weight per passenger between the American and English cars, except where special cars are used; but there is much difference in the weight of the trains, the American trains often exceeding 1 ton per passenger. A long distance limited train here carrying 150 passengers would probably weigh 290,000 lbs., or 62 per cent. more than the Scotch express. Light weight of fast trains renders it possible to do the work with one pair of driving wheels, thus avoiding that great source of annoyance and danger, broken crank pins and coupling rods. If the work can be done with one pair of driving wheels they can be made extra large, thus giving slow piston speed and all its attendant benefits. Another advantage to be gained by light trains is in the direction of cleanliness; much of the dirt now thrown from the chimney is a waste of fuel due to overwork. Give the American locomotive a fair chance and it would equal any other in economy and cleanliness.

One prominent feature in many foreign trains is the absence of trucks and small wheels under locomotives, cars and tenders, thus reducing the number of parts, lessening journal friction and avoiding flange wear; it seems that where short trucks are used the result is a wriggling motion, and they cause the very evil that they are intended to prevent. If you look over a good many cars you will find that those with the longest trucks have the flanges worn the least, other things being equal. Years ago there was quite a fever to get the trucks to turn as easily as possible; but it was found that with such trucks the flanges were worn off before the wheels were worn out, on account of the constant wriggling of the truck from side to side; but that is not so with a rigid wheel base.

Probably the continuous train brake has done as much to prepare the way for high speed as any device that has ever been added to the train; for there can be no safety without means of stopping quickly. Many of the worst accidents which have occurred on railroads have been caused by inventions introduced as measures of safety, the virtues and vices of which had not been duly considered.

The necessity for simple and absolute block signals is so patent that no time need be wasted on the subject. A good many signals have been too complicated, and there have been too many to look out for. Much might be said as to the

necessity of a good road-bed and track to insure comfort and safety in quick journeys.

When the roadbed and track shall have been put in perfect order, all grade crossings avoided, the passage by way stations made safe, the best of safety signals applied, good fuel provided, the weight of trains reduced to the minimum, then, and not till then, will the prophecy be fulfilled. "They shall run like the lightnings."

The PRESIDENT: In the statistics which have been given in the able paper which has been presented I notice a uniformity in the running of one of the trains on one of the English lines between London and Edinburgh and the so-called "Flying Dude" train on the Old Colony road. The weights of the trains, including the locomotives, if I remember right, are about the same, and the speeds approach each other, that of the English train being the highest; and the amount of fuel consumed per mile, notwithstanding our fuel is inferior to the English, is about the same in one case as in the other. When you take into account the inferior quality of our coal as compared with theirs, I presume the performance of our engine is as good as that of the European one.

Mr. SINCLAIR: Mr. Richards in his paper describes the way in which fast trains are run in England, evidently looking to the time when our speeds will be accelerated, and, as I understand the paper, it means that we will have to follow the conditions here that are followed in England, if we are to make the same time and distance. The conditions of our railroads are not such as to make very high speed possible for many years, except in very exceptional instances. First, there are too many crossings; you cannot maintain a speed of 50 or 60 miles an hour, and pull down the speed every ten miles, and there are few roads on this continent where you can run much farther without the necessity of reducing speed. Mr. Richards puts considerable stress on the advantage of running with single drivers and arrangements that do away with side rods. That condition of pulling a train is only possible where you have to lift it into motion only once in 70 or 100 miles. If an engine has to drag a train to speed every ten miles, you want all the adhesion you can get, and unless you have it, there will be more waste of fuel and wear of machinery. Until you run a train without shutting off steam for 100 miles, you cannot attain the high velocities common in Europe.

Mr. RICHARDS: With regard to running with one pair of driving wheels, this is not done in England, where frequent stops are made. All suburban work on English roads is done with two pairs of drivers.

Mr. SINCLAIR: I was much struck two years ago, in riding between London and Crewe, 158 miles, in observing the running of the train. The engineer only shut off steam once, and it seemed, after the speed was attained, that there was no difficulty in holding it, but when the steam was shut off and the speed ran down to 20 miles an hour, it took a good many miles to get it back to 60 miles an hour again, showing that it is the long run that tells, and such long runs are impracticable here. On this occasion I was permitted by Mr. Webb to ride on the compound engine. I was permitted to ride on an engine on the Pennsylvania limited, the fast train between New York and Philadelphia, and it was very hard work to keep up the speed; as soon as the fire got a little dirty it seemed almost impossible; the trains on that road are heavier than the English one I referred to.

The PRESIDENT: It seems to me that the whole question of making fast runs depends largely upon weight. Our engines are of ample capacity, the running gear under the cars is amply designed to admit of high speed; but the rail is undoubtedly the weakest of our appliances. It is only by bringing our rolling stock to such high perfection as we have that we have reached the speed we have attained. The American locomotive is better than the English, inasmuch as it will run on English roads as well as theirs, and will run on ours, while theirs will not run on ours.

The question was further discussed by Messrs. Adams, Davidson, Brown, Folsom, Snow and others.

The President announced as the subject for discussion at the next meeting, "Running Gear for Freight Cars, with the possibility of adopting a Standard Truck for the Railroads of America," the discussion to be opened by Mr. Osgood Bradley.

A Semaphore Showing Color at Night.

There are very many railroad men who, if they had to choose between a color signal and a position signal, would take the color signal. When it is recalled that since the earliest days of railroading a red light has been the danger signal on posts, on switches, on the rear of trains, and in hand lanterns, while a white light has always signified safety, it is evident that the opposition to abandoning the red light for danger has deep roots.

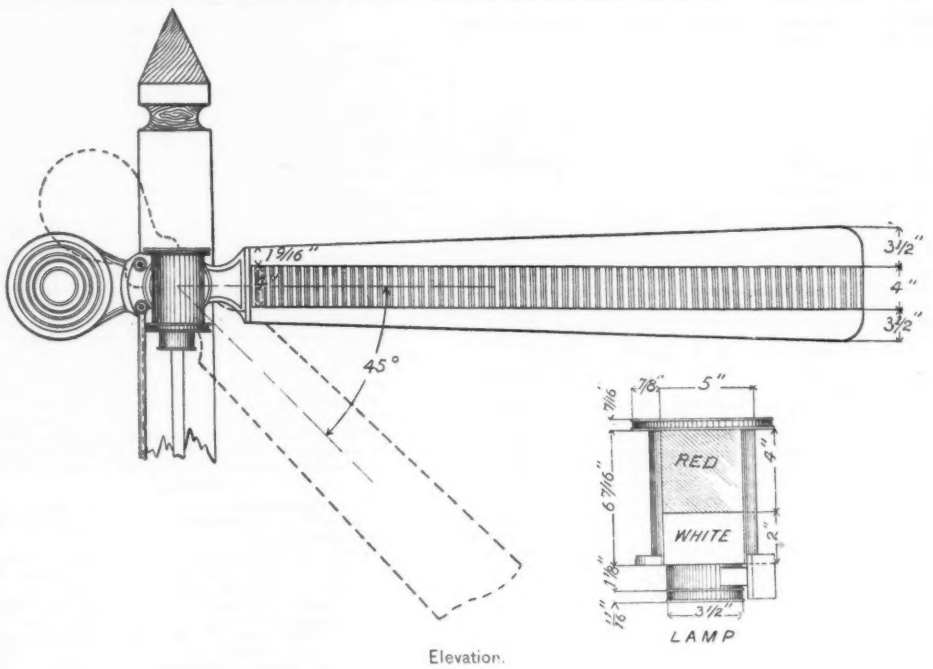
The semaphore has been for years accepted as the best position signal in use, and a semaphore which will answer for both day and night would be a desirable addition to the equipment of a railroad. There have been many attempts during the past twenty years at such an invention, but the results have always been illuminated semaphores which gave so little light that they could be seen only under favorable circumstances, and at short distances.

The parabolic semaphore, however, invented by C. Herschel Koyl, of Swarthmore, Pa., and shown in the accompanying cut, presents an area of such dimensions and so confines the light to the track that under ordinary circumstances it can be seen at a half mile as an arm of definite size, red at the horizontal and changing to white or green when dropped.

The reflecting surface and the frame which incloses it form a longitudinal section of a paraboloid. This is mounted in the ordinary casting which supports the semaphore arm, and rotates about the axis in the post, which is also the axis of the paraboloid, in the focus of which the lamp is placed. To a front view the semaphore presents the dimensions of 5 ft. 6 in. in length, from the axis to the end of the blade, and 11 in. in width, and has a reflector 4 in. wide along the centre, from end to end.

A reflecting surface of the form specified has the property of making parallel all rays which fall upon it from the focus, the consequence being that there is sent along the track by this means a continuous band or beam of light of definite dimensions.

The specification of the patent also says, "in view of the fact that this band or beam should be of such dimensions that at the conventional distance at which the signal comes under the observation of the engineer it shall be wide enough to extend across the track to which it is appropriated, and deep or broad enough to about cover the observation portion of the cab of the engine, it will be found desirable to slightly modify both the longitudinal and transverse curvature of the paraboloidal section which forms the reflecting surface, so that at such distance there will be sufficient divergence of the rays to produce a beam of the dimensions indicated. To accomplish this result, however, the modification in form of the reflector need be very slight, and it remains to all intents and purposes of the contour of the section of a paraboloid."



THE PARABOLIC SEMAPHORE.

The object has been to concentrate upon the track all the light from the arm, and then to diverge it only so much as the necessities of the case may require, the method adopted for diverging it being to slightly corrugate the reflector at right angles to the four directions in which the divergence is required.

The result is a semaphore which presents the same appearance by day and by night, which combines the excellencies of a color signal with those of a position signal, and the absence of which, therefore, should the lamp go out, would immediately be noticed, as is not always the case with any night signal at present in use. It is easily adaptable to existing systems, because the new arm fits the castings at present in use, and no further trouble or change is necessary than to remove the old board and put this in its place, setting the lamp upon a bracket in front. The upper half of the lamp being red, and the lower part clear (or green), the arm when horizontal appears red, and when dropped, white or green, as the case may be. The reflector is of glass, with silver (not mercury) on the back surface, and, therefore, will not lose its reflecting power by exposure to the weather.

One of these semaphores has been in use for some time on the Lehigh Valley road, at Easton, and another has been erected at Bethlehem. The signal is found to be visible at any practicable distance, and it is wonderfully striking.

American Society of Mechanical Engineers.

The eighteenth meeting of this society began at Scranton, Pa., on Oct. 15, the first session being called to order at 8:30 p. m. by Vice-President C. J. H. Woodbury, of Boston. About 125 members were present. Mr. Woodbury feelingly alluded to the serious illness of President Horace See, of Philadelphia, but was gratified to be able to announce that the crisis had passed.

He then introduced Mr. J. A. Price, of Scranton, who said it was a great pleasure to welcome the American Mechanical Engineers to the capital city of the anthracite coal field. We welome you to the most elaborate system of anthracite mining on the continent. You may think our resources about to be exhausted, but it is proved beyond peradventure that abandoned mines are prolific of mushrooms, so you see we have something left after the coal is gone. Here you will find the finest and best mechanical power in the country. Your work is only begun. The present is nothing to the future. You represent the flower and fruitage of your department of mechanics, but you will fall short of your duty if you do not aim to stem the tide of emigration pouring in upon our shores by educating it. You are or should be a body of moral educators to safely dispose of the horde entering our door. We must educate that horde. The speaker expected that in the domain of applied power coal will yet be brought from the mines in the form of gas, and countless other quite as surprising—seemingly miraculous now—achievements will become actual and commonplace.

Vice-President and Chairman C. J. H. Woodbury responded. He said: We are here because we realize our ignorance. The onward progress of engineering is keeping pace with the advance of civilization like a bird on the wing. Individual experience is limited, the books are necessarily behind the times, and it is at these meetings that we expect to receive the truths of to-day in engineering. I would be the last to cast any general reflection on the value of organized mathematical principles which are expressed in formulæ, but it should be remembered that every formula must contain a constant before it can be applied, and that constant means simply facts. Facts are fugitive things, eluding all except the most persistent; and this meeting, whether in the sessions devoted to papers and discussions, or in the excursions to some of your engineering works, will all be devoted to facts. The great apostle boasted that he was a citizen of no mean city, and your municipality is known over the country for its enterprise, skill and business integrity. It would be invidious to make distinctions, but we all know how the late Moses Taylor, with wisdom to plan and vigor to execute, gave industries here the benefit of his capital and financial experience; and in this connection a passing reference is due to William Scranton, of your city, as a pioneer in the introduction of new machinery and improved methods of ste manufacture.

Two papers were then read by Dr. R. H. Thurston, o Cornell University, the first on "Distribution of the Interna Friction of Steam Engines," the second on "Variable Load Internal Friction and Engine Speed." He was followed by Prof. J. E. Denton, of Stevens Institute, with a paper "On the Friction of Piston Packing Rings in Steam Cylinders."

An abstract of Prof. Denton's paper is given elsewhere in this issue.

As these papers were all devoted, in part at least, to the question of friction, they were discussed jointly.

The discussion was opened by Prof. J. E. Denton, who called attention to the fact that in the tests as given in Dr. Thurston's paper, it appeared that in some cases the friction decreased with the increase of load. It was his belief that this was due to the pumping action of the bearings in drawing oil from the oil cups. An oil cup, which will not permit of the passage of oil, as held in the hand, will give down sufficient oil for lubrication when the aperture is placed in contact with a revolving shaft.

Mr. F. Schumann, referring to Prof. Denton's device for determining the friction of piston packing, said that he did not think it corresponded with practice for the reason that the two end rings on the piston, as shown in the drawing, prevented the steam from having access to the indicating ring, which changed the conditions under which it acted.

Mr. W. F. Durfee said that in the case of the vertical engine the water from the condensed steam was distributed evenly throughout the cylinder, while in the case of the horizontal engine the condensation was on the bottom, and consequently the lower part of the cylinder was benefitted. He had known of several vertical engines which had run for several years without lubrication, and the cylinders remained in much better condition than in the case of horizontal engines run for the same length of time under like conditions.

Mr. Thomas S. Crane thought that all must be familiar with the fact that 30 years ago all engines were run without oil for cylinder lubrication. All engines were put up without facilities for lubricating. The piston rings were set, the engines run for a week in the shop, and then they were taken apart and shipped.

Mr. William F. Mattes did not wish to challenge Prof. Denton's theory as to the reason for the friction decreasing with the load, but he believed there was a limitation as to the increase of load, for we frequently reach that point where the journals and crank-pin become hot. This, however, may be due to the distortion of the surfaces rather than an increase of the friction under normal conditions.

Mr. J. F. Holloway believed a very important element had been left out of consideration. There is great variation in piston packings. The amount of friction varies not so much with reference to lubrication as the character of the ring. It was the practice years ago to use packing set out by springs. A few years ago it was the general opinion when anything was wrong with an engine, that the proper thing to do was to set out the packing. If an engine did not run well the packing was set out. If an engineer took hold of a new engine the first thing he did was to set out the packing. Some time ago an attempt was made to introduce self-setting packing on the lake propeller engines. In starting, the levers were worked by hand, and the engineer sometimes had pretty lively work in working the starting bar to keep up with the engine. With the new packing he complained that the engine ran so easily he couldn't handle it.

Mr. W. E. Crane did not agree with Prof. Denton altogether as to the lubricating properties of steam. He had set up an engine where the steam was taken through a long pipe which was unprotected. While this was the case it was necessary to lubricate the cylinder, but after the pipe was covered, and the steam consequently dryer, the use of oil became unnecessary.

Prof. R. H. Thurston closed the discussion by complimenting the very ingenious device explained by Professor Denton for denoting the piston friction. He considered it one of the prettiest things he had seen in a long time. Regarding the decrease of friction with the increase of load, he attributed it to the difference in lubrication. It was next to impossible to so lubricate that the effect would be the same for ten continuous seconds. The rate of speed of an engine also affected the friction. The irregularity of the results had not surprised him. The final result shows that the practice of engineers has been correct and that the text books are wrong. There was no doubt that the distortion of bearings affected the results. He had charge of the machinery of the iron-clad "Dictator" during the latter part of the war. This vessel had a main journal 21 in. in diameter and 26 in. long. That at first seemed to him to be pretty short, but as it had been designed by Captain Ericsson and according to the Captain's theory, he supposed it was all right. At the end of the first trip they were compelled to file up the journal and clean out this bearing. They found it had been cut down ¼ in. in diameter, and the journal was afterward lengthened to 32 in. and another trial was made with similar results. They finally put in a spring shaft 2 ft. long, making a total of from 55 to 60 in., but it still gave a great deal of trouble. They finally decided that the shaft was not strong enough for the work it had to do, and that it sprung. The experience had been valuable to him, and he was afterwards always careful to see that journals were of ample diameter.

Prof. J. E. Denton, in closing the discussion on the three papers, said that while it was true that it was the practice years ago to run engines a long time without oil, they did not have slide valves. He had made a test on a locomotive, cutting down the supply of oil from a pint in 75 miles to a pint in 160 miles. As soon as the valves got short of oil two men could not hold the lever when out of the notch. In regard to packing there had been a general gravitation to the simple spring ring, and if well fitted the slightest pressure would keep it tight. With 3 lbs. to the square inch on the ring of his apparatus there was not the least leakage. The spring ring packing was being used for locomotives and marine engines. He had traced up the records of many improved packings and found there was nothing in them.

The first hour of Tuesday's session was devoted to the consideration of the society's business affairs. An invitation had been extended to the society by the Institution of Great Britain to visit Europe next year on the occasion of the Paris Exposition of 1889. The acceptance of the invitation was under advisement.

The council had accepted the invitation of friends in Erie, Pa., to hold the spring meeting in that city.

The membership of the society at this date is as follows: Members, 802; associate members, 40; juniors, 61; total, 903. Commendable progress had been made in the establishment of a library, and by the will of the late Alfred B. Couch, of Philadelphia, the valuable collection of books accumulated by him would pass into the possession of the society.

The tellers reported the election of the following officers for the ensuing year: President, Henry R. Towne; Vice-Presidents, William Kent, Thomas J. Borden, Charles B. Richards. Managers: Frank H. Ball, William Forsyth, George M. Bond. Treasurer, William H. Wiley.

The secretary announced that a letter had been received from the Franklin Institute Committee on Science and Arts to the effect that certain medals and rewards are at the disposal of the Committee for meritorious inventions and improvements in machinery.

A paper was then read by Mr. Charles T. Main, of Lawrence, Mass., "On the Use of Compound Engines for Manufacturing Purposes." An abstract of which follows:

THE USE OF COMPOUND ENGINES FOR MANUFACTURING PURPOSES.

In many manufactories, so much steam is used for purposes other than power that frequently where the exhaust from the engines is available for heating, nothing is gained by using a very economical engine. Mr. Main discusses this point quite fully, and assuming that when engines are running without utilizing any of the exhaust, a compound engine will require 1¾ lbs. of coal hourly per indicated horse-power, a simple condensing engine 2½ lbs., and a non-condensing engine 3 lbs. He shows the effect on the economy of using various fractions of the exhaust for heating.

All the running expenses are also tabulated, and the writer draws the conclusions "that if an amount of exhaust steam can be constantly used up to about 80 to 85 per cent. of the whole amount exhausted from a high-pressure engine, the most economical plant to put in would be a special form of compound engine, but if more than 80 to 85 per cent. of the exhaust could be used for heating purposes, then the proper type would be the high-pressure, non-condensing. The condensing engine, running with a portion high pressure, comes between the compound and non-condensing in running expense below 75 per cent. of the amount of exhaust steam used, and above 75 per cent. it becomes a regular non-condensing engine."

The proportion of compound engines used in manfactories are illustrated by a number of interesting examples, with accounts of performance in some instances.

From these examples and other considerations Mr. Main recommends the following as the proper proportions for the cylinders of compound engines when all the steam is used for power:

RATIOS OF AREAS OF CYLINDERS.

Receiver pressure.	Boiler pressure.	
	100 lbs.	125 lbs.
5 lbs.	1 to 3.50	1 to 4.00
10 lbs.	1 to 3.75	1 to 4.25
15 lbs.	1 to 4.00	1 to 4.50

For boiler pressures above 125 lbs. the triple expansion engine is recommended.

If some of the exhaust is to be used for heating, the proportions of cylinders should be changed accordingly. "Thus, if 25 per cent. of steam is taken out from the receiver, the average pressure of which is 5 lbs., the proper ratio of areas of cylinder would be 3.5 × .75 = 2.625 for 100 lbs. boiler pressure."

Usually the amount of steam required for heating in factories is not constant, more steam being used in winter than in summer, and the demands at different hours of each day often varying considerably. The manner of designing and operating an engine under such conditions is illustrated by several practical examples.

With variable use of exhaust steam Mr. Main recommends the tandem compound engine, and in addition to the cut-off on low pressure cylinders regulated by hand, he has devised an automatic "regulator for receiver pressure," which he shows, by results of tests, to act very efficiently.

Prof. Thurston had recently given considerable attention to the relative merits of water and steam power. In his case where 1,000 h. p. was obtainable at certain seasons of the year, at others there would be no surplus water beyond the leakage from a plant of that size. If the supply was short in mid-summer this would not be objectionable, but the shortage was liable to occur at any season of the year. Another objection was the difficulty of securing accurate regulation such as is necessary in driving electric light apparatus. Where the load is continuous there may be little difficulty. Sometimes the attachment of a governor increased the irregularity. Another factor in the case was the growing economy in the production of steam power. It was owing to these facts, and that our streams were becoming more and more irregular, that the use of steam was growing in favor.

Prof. Denton called attention to the fact that the authoritative statement made a few years ago that water power was infinitely cheaper than steam was erroneous, because no account had been taken of repairs in the water power plant.

Prof. D. V. Wood thought that the uncertainty of water power was sufficient to account for its diplacement by steam. As an illustration of the commercial conditions he cited the case of canals which could transport freight cheaper than railroads, yet the railroads were drying up the canals, because the time saved by railroad transportation was an important factor for the consideration of shippers.

Referring to the paper, he thought there was an important omission of the heating power of coal in giving the weight consumed per horse-power per hour, as there was such a great difference in coal. Within a year a triple expansion steamer had been launched in England, in the contract for which it was stipulated that the consumption of coal should not exceed 1¼ lbs. per indicated horse-power. In actual trial but $1\frac{23}{100}$ lbs. were used per horse-power—a very low figure. It would have interested him very much to have learned whether the $1\frac{23}{100}$ lbs., as stated in Mr. Main's paper, was an equally good showing.

Mr. Main, in closing the discussion, said that he had not been able to obtain the cost of repairs from actual experience, as sufficient time had not elapsed to give him reliable data. The cost of repairs had been carefully estimated. When running a 500 horse-power engine the exhaust steam had been utilized in the dye house, but they had found when the engine was shut down, that the dye house required more steam than it did before. This he believed was owing to the fact that the engine served as a kind of regulator—that the dye house could get no more steam than came through the engine, but that when they could draw all they pleased their consumption was greater. The relative cost of water and steam power was a very complex question. The cost of steam depended on the price of coal and the utilization of exhaust steam. The cost of water power is represented by the cost and maintenance of dams, flumes, wheels, etc. The cost of a large plant per horse-power was higher than that of a small one. In the installation of steam plants the reverse was the case. On the Merrimac River, where there are several lakes to draw from, the high water frequently decreases the power. In the year 1886 he had observed 25 days when the power was decreased 25 per cent. on account of high water. When using water-power, with no steam plant, if there was irregularity in the flow, the mill was shut down, and the best help would leave on account of the uncertainty of employment. It was therefore necessary in such cases to have a double plant. In preparing his paper he had been unable to obtain the data regarding the heating power of the coal used.

Mr. W. F. Mattes, Chairman of the Local Committee, announced that his colleagues would be in attendance at 2 o'clock to escort the members to an inspection of the works of the Lackawanna Iron & Coal Co. He believed that they were producing steam cheaper than anywhere else in the world, without excepting the natural gas region. They were using culm as fuel, which it had formerly cost them five cents per ton to throw away. They mined their own coal, but as there was no market for the pea and buckwheat sizes they were included in the culm, which was consequently a superior article to the ordinary coal waste known by that name.

Papers were then read by Prof. Charles H. Peabody, of the Massachusetts School of Technology, on the "Flow of Steam in a Tube" and "A Simple Calorimeter." Abstracts follow.

FLOW OF STEAM IN A TUBE.

In these experiments the steam flowed through a brass tube, having an internal diameter of 0.275 in. and a length of 8 in. A plate, 1½ in. in diameter, with rounded orifice, was driven on flush at the admission end of the tube. This end of the tube was connected with an iron pipe 6 in. in diameter and 2 ft. long. The tube discharged into another iron pipe of the same dimensions as the supply pipe. The two iron pipes were capped on the outer ends, and a plate holding the experimental tube was secured between two flanges on the inner ends of these pipes. The whole apparatus was lagged on the outside, the plate holding the tube being covered on both sides with about 4 in. of asbestos. Steam was supplied by a lagged pipe, 1 in. in diameter, and led away by a pipe of the same size, each of these pipes having a stop valve near the apparatus. In making an experiment, the supply valve was opened wide and the discharge valve was regulated so as to maintain the desired difference of pressure on the two sides of the plate. A steam gauge and a thermometer cup were placed in each of the iron pipes. The exhaust steam was conducted to a surface condenser, condensed and weighed before taking observations; the apparatus was operated until the action became steady.

Careful experiments on the flow of steam made with good apparatus are exceedingly rare, so that the present results are of considerable interest. They are given in the accompanying table, together with the results calculated by one of the most approved theoretical formulas, and show clearly that the theory of the efflux of steam from tubes is at present far from complete.

	Pressure of steam in front of tube.	Pressure of steam beyond tube	Difference of pressures.....	Flow of steam per hour by tank in pounds. *Gt*.....	Flow of steam per hour, calculated in pounds. *Gc*..	$\frac{Gt}{Gc}$
1.....	69.1	4.4	64.7	229.0	182.3	1.260
2.....	69.6	9.7	59.9	230.4	211.2	1.091
3.....	71.3	14.8	56.6	242.0	233.4	1.037
4.....	69.1	19.4	49.7	232	242.2	0.958
5.....	70.0	24.5	46.5	234.5	256.6	0.914
6.....	70.3	29.1	41.2	229.0	261.5	0.876
7.....	72.0	34.2	37.8	232.0	268.9	0.860
8.....	72.0	39.5	32.5	221.4	266.9	0.830
9.....	71.6	44.2	27.4	216.5	260.1	0.833

The steam supplied in these experiments contained from 1 to 1½ per cent. of moisture. In calculating the foregoing table it was assumed that the amount of moisture was uniformly 2 per cent.

A SIMPLE CALORIMETER.

This consists of a small reservoir made of iron pipe with capped ends; the sizes already constructed being

1. 6 in. pipe, 10 in. long.
2. 4 in. pipe, 8 in. long.
3. 2 in pipe, 8 in. long.

The reservoir is connected to the main steam pipe or boiler by a pipe ¼ in. in diameter, and a pipe 1 in. in diameter conducts away the exhaust steam. The first pipe has a stop-valve, and the top of the reservoir is fitted with a thermometer cup and a steam gauge. In making an experiment, the stop-valve is opened slightly (about ⅛ turn) so that the steam is wire-drawn and superheated, the reduced pressure being indicated by the steam gauge connected to the reservoir, and the temperature of superheat by a thermometer placed in the cup. All forms of the calorimeter gave satisfactory results, but the smaller ones were more sensitive.

The manner of calculating the amount of priming from the indications of this calorimeter is as follows;

Let P = boiler pressure, pounds per sq. in.
p = pressure in calorimeter pounds per sq. in.
H = total heat of vaporization at pressure P, B. T. U.
h = total heat of vaporization at pressure p, B. T. U.
q = heat of water at pressure P, B. T. U.
T = temperature, Fahrenheit, of steam at pressure P.
t = temperature, Fahrenheit, of superheat.
x = dry steam per pound of mixture drawn from boiler, lb.
M = per cent of priming.

$$x = \frac{h + 0.4808 \times (t - T)}{H} - q$$

$$M = 100 \times (1 - x).$$

The results of some comparative experiments with the three calorometers are shown in the accompanying table, the several groups of experiments being made simultaneously:

BAROMETER, 14.8 LBS.

Size of calorimeter. Inches.	Gauge Pressures.		Temperature in the calorimeter, F.	Priming.
	Boiler.	Calorimeter.		
2	71.3	37.5	288.1	0.01
4	71.3	38.3	288.9	0.01
6	57.0	9.5	246.2	0.018
4	57.0	8.4	245.8	0.018
2	57.0	7.3	242.6	0.019
4	60.8	4.7	246.6	0.017
2	60.8	4.7	244.0	0.018
4	71.2	6.2	248.4	0.02
2	71.2	6.5	248.4	0.02
4	73.0	6.6	251.2	0.02
2	73.0	6.9	250.5	0.02
4	74.5	6.8	252.5	0.019
2	74.5	7.0	251.6	0.019
4	75.5	6.2	253.4	0.018
2	75.5	6.7	252.0	0.018
6	69.8	12.0	268.2	0.012
6	69.8	5.0	253.4	0.016

The range of this calorimeter is comparatively small, as indicated by the table below, it being assumed that the pres-

sure of the steam is reduced by wire drawing, in every instance, to the pressure of the atmosphere.

Pressure.		Priming.
Absolute.	Gauge.	
300	285.3	0.077
250	235.3	0.070
200	185.3	0.061
175	160.3	0.058
150	135.3	0.052
125	110.3	0.046
100	85.3	0.040
75	60.3	0.032
50	35.3	0.023

If the exhaust pipe from the calorimeter can be connected to a condenser the range of the instrument is increased. For example, with 100 lbs. boiler pressure, and 3 lbs. in the reservoir, the limit is raised from 0.046 to 0.064.

Slight errors in reading the temperature affect the result but little, except in the case where the calorimeter is used near its limit.

The simplicity of construction and the ease with which this calorimeter can be manipulated will doubtless commend it to engineers.

The papers were discussed by Prof. Denton, who stated that there was quite a discrepancy between these results obtained in observing the flow of steam and those which had been derived from experiments during the past 30 years.

Professor Peabody expressed entire confidence in the figures prepared by himself and associates, and stated that they had been careful not to publish any report until they were well satisfied as to its reliability.

The afternoon was devoted to an inspection of the Lackawana Iron & Coal Company's Works.

An informal reception was tendered the visiting engineers on Tuesday evening by the citizens of Scranton through the Board of Trade.

The Wednesday morning session opened with the presentation of the following papers: "System of Worm Gearing of Diametral Pitch," by S. W. Powel and W. L Cheney; "An Improved Method of Finding the Diameter of Cone and Step Pulleys," by C. A. Smith; "Some Tests of the Strength of Cast Iron," by Gaetano Lanza; "A Foundry Cupola Experience," by Fred. A. Scheffler; and "On the Identification of Dry Steam," by Professor Denton. An abstract follows:

THE IDENTIFICATION OF DRY STEAM.

This paper describes observations on steam flowing from small orifices in insulated pipes, the quality of the steam being measured by condensing it and noting the amount of heat imparted to the condensing water. Steam which was slightly superheated or dry was transparent close to the discharge orifice, while most steam issued as white mist. Mr. Denton concludes that

"I. It appears from the preceding investigation that jets of steam show unmistakable change of appearance to the eye when steam varies less than one per cent. from the condition of saturation either in the direction of wetness or superheating.

"II. It appears from the investigation following in Part II. that the instrumental error of portable condensing calorimeters does not theoretically interfere with the measurement of about one per cent. of variation in the heat of saturated steam. But in the use of such calorimeters there has always been found to exist an accidental variation or error considerably in excess of the theoretical instrumental error, even Regnault's magnificent work not being an exception in this respect. Consequently, if a jet of steam flows from a boiler under circumstances such that very little loss of heat occurs through radiation, etc., and the jet be transparent close to the orifice, or be even of a grayish white color, the steam may be assumed to be so nearly dry that no portable condensing calorimeter will be capable of measuring the amount of water in steam. If the jet be strongly white, the amount of water may be roughly judged up to about 2 per cent, but beyond this a calorimeter only can determine the exact amount of moisture.

"III. A common brass pet cock may be used as an orifice, but it should, if possible, be set into the steam drum of the boiler, and never be placed further away from the latter than 4 ft., and then only when the intermediate reservoir or pipe is well covered."

So much has been written for and against the reliability of experiments made with the ordinary barrel calorimeter for determining the quality of steam, that the second part of Mr. Denton's paper, discussing the effect of errors of observation, is of peculiar interest. It is gratifying to find that the practice of the majority of engineers is justified by the mathematical discussion, from which the following conclusions are drawn:

"I. That for weights of condensing water from 300 to 5 lbs., and weights of condensed steam from 25 to $\frac{3}{8}$ lbs., the instrumental error cannot give rise to discrepancies in duplicate tests greater than $2\frac{3}{4}$ per cent., and the probable error is about one-half per cent., provided that temperatures are determined to one-tenth degree, Fahrenheit, steam pressures to 3 lbs. per sq. in., weight of condensing water to $\frac{1}{100}$ lb., and the weights of condensed steam to one-fourth per cent., *and that the weight of condensing water is not more than thirteen times the weight of steam condensed, or the range of temperature not less than* 85°.

"II. That for the above conditions the magnitude of the several partial errors are as follows:

Error due to weight of condensed steam	+ 0.35
" " initial temperature of water	+ 0.15
" " final " " "	− 0.32
" " weight of condensing water	− 0.06
" " steam pressure	+ 0.24

"III. As the ratio of the weight of condensing water to the weight of steam condeensed xceeds thirteen to one, the errors due to the temperatures are proportionately increased —all other errors remaining sensibly constant.

"*Consequently the lower the range of temperature in the calorimeter the greater the error, for example for a range of* 5° the condensing water must be 239 times the steam condensed, and the errors of final and initial temperatures would be $\frac{239}{13} = 18$ times the amount in II *The most general law is therefore that the total error is a minimum when the range of temperatures in the calorimeter is greatest.*"

Mr. Chas. E. Emery considered the paper a valuable contribution to the literature of the subject. It was a very common practice to test the moisture of steam by its appearance upon issuing from a cock. What quantity of water was required to make the change had not been known to him, and he was gratified to learn that it was so small a percentage. A slight current of steam was sufficient to carry water along a pipe. In supplying steam for Madison avenue, New York, a line of 11-in. pipe had been laid down, going up a grade of 1 to 15. At present only two houses were supplied from the pipe, and he had put in a trap at the bottom of the grade. Although the steam drawn from the pipe was only one-fiftieth of its capacity, he had found it necessary to put in other traps to prevent the water from being carried into the houses beyond the grade.

Prof. Denton said that the departure of one per cent. of dryness could not fail of recognition by any one who had once seen it; when we went beyond two per cent., however, it was all white. If it is a fact that moisture in steam is always shown by irregularity, it is also a fact that boilers have been suspected of giving more moisture than they really do. Nine out of ten boilers give steam close to dryness if they run regularly. If a jet flowed into saturated atmosphere, he thought there would be a difference, as steam changes to white under the influence of the moisture of the atmosphere. He had endeavored to make this test but had not succeeded in finding the air in such a condition in the boiler-room. A difference of pressure would affect the tests, and for that reason they had been made at the stated pressures of 55 and 95 lbs. Referring to Mr. Emery's experience with water being carried by a current of steam, it was necessary to go back to within 40 in. of the boiler and find the jet white before the moisture can be laid to the boiler.

A paper was then presented by Mr. Emery "On the Cost of Power in Non-Condensing Engines."

Professor Lanza's paper on "Counterbalancing of Locomotives" was presented by the Secretary. An abstract is given elsewhere. Mr. Emery considered the subject too important to pass without comment. "Any one," said he, "living near a railroad can easily tell the difference in the revolution of the drivers of a locomotive going down grade, by the difference in vibration. Those who wish to make their engines run easily get in so much counterbalance that there is a great difference in adhesion when at speed due to the flopping action. Captain John Ericsson has pointed out the only way in which the reciprocating parts can be thoroughly balanced. It is by putting in a counterbalancing weight moving in the opposite direction from that of the piston. This involves a beam and a heavy weight, but in this way locomotives can be balanced and run steadily on the track, and at the same time not have this very decidedly varying load on the wheels due to centrifugal action of the weights, and without varying the adhesion, as is the case with the present plan."

Topical question No. 70 was then taken up, which was as follows:

"Is there any recognized method of deciding proper sizes of tap-drills for given threads and for different materials? and, if not, would it not be advisable to formulate one based upon the amount of metal corresponding to some fraction of depth of thread to be left in the hole to be operated upon by the tap for each material?"

Mr. Wm. M. Barr said that he had been experimenting in that very direction. He had not found so much trouble with the drill as with the tap. Regarding cast iron, he had not been able to make studs and nuts with the standard taps and drills. The trouble with the drill is that in cast iron it makes a hole larger than itself, and this is partially due to the grinding. He knew of but one grinder which would grind a drill so that the point would be equidistant from the circumference all round. The Pratt & Whitney Co. have brought out a standard thread and gauge, which they work by. If we have two sizes of taps, one may be too small and the other too large. The die is a variable thing. If we have a standard tap it is an easy matter to set the die.

Prof. John E. Sweet thought that the difficulty arising when the drill did not pass through the cast-iron could be obviated by chambering out the bottom of the hole, which he did by using what they called a "wobble" drill, a tool which was not in the market, but which he thought should be.

Announcements were made by the Secretary of excursions during the afternoon, which embraced visits to the works of the Dickson Mfg. Co., the Pine Brook colliery, and the Boies Steel Car Wheel Works.

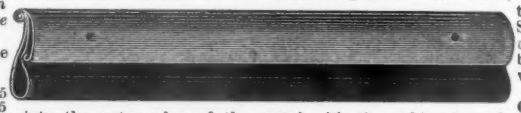
At the Wednesday evening session papers were read by Prof. J. B. Webb on "The Overhauling of a Mechanical Power" and "The Mechanics of the Injector."

Mr. Wm. Kent said Prof. Webb is no doubt correct if we consider the injector as a means of raising water from one level to a higher one, but if it is used for feeding water into a boiler, say from a tank on or above the boiler level, then the injector has a perfect efficiency, less the heat lost by radiation, which, if the injector and pipes connected to it are felted, is almost nothing. In this case its efficiency is the same as that of a steam trap which feeds a steam boiler without any expenditure of energy other than that necessary to open and close the valves, and loses no heat except that due to radiation from its external surface. As a pump for lifting the injector is very inefficient, but as a boiler feeder its efficiency is almost perfect.

Prof. Denton replied that in Prof. Webb's paper we were shown a physical reason why the injector was not as efficient as the pump. Although the injector used steam expansively, all the energy went into impact, and over $\frac{15}{16}$ of it was lost.

The Cosper Weather Strip.

The weather strip shown herewith is patented and made by Mr. W. H. Cosper, of Chicago, and is said to have been received with much favor by railroads. The feature of particular merit claimed for this weather strip is the wire drawn



into the outer edge of the metal with the rubber turned around it. This holds the rubber more firmly in the metal and stiffens the outer edges of the strip, preventing it from lifting between the nails when applied. It makes a neat molding, and effectually excludes cold air and dust.

TECHNICAL.

Locomotive Building.

The Central of New Jersey will shortly close a contract for the construction of 30 new consolidation locomotives, with the Wootten fire-box, to burn anthracite buckwheat coal.

The Cooke Locomotive Works, of Paterson, N. J., last week completed four more of the large order of passenger locomotives for the Southern Pacific.

The Hinckley Locomotive Works of Boston last week delivered a passenger locomotive to the Alabama Great Southern.

The Mexican National received a large number of freight locomotives this week.

Car Notes.

McKee, Fuller & Co., of Catasauqua, Pa., have secured a contract for building 2,000 gondola cars for the Lehigh Valley, for which the Catasauqua Iron Works is to supply the iron bars and other iron materials.

The Central of New Jersey has contracted for the building of 2,000 forty and fifty ton cars, of which 1,500 are coal cars and 500 box cars, and in a few days an additional order for 30 passenger coaches will be awarded. The new cars will be built partly at the Milton Car Works, Limited, Milton, Pa., and partly at a car works in the Lehigh Valley. Considerable iron work will be required in the fulfillment of these orders.

The Indianapolis Car & Manufacturing Co. has been awarded the contract to build 250 box cars for the Chesapeake & Ohio, and has been asked to bid on 1,000 coal cars for another road for which they last year built several hundred cars.

The Terra Haute Car & Manufacturing Co., of Terra Haute, Ind., has delivered a number of box cars to the Charleston, Cincinnati & Chicago.

The Tennessee Coal, Iron & Railroad Co. has placed an order for building 100 coal cars of a capacity of 50,000 lbs. each with the St. Louis Car Works, St. Louis, Mo. The cars will be of the drop-bottom pattern, and are expected to be finished by Jan. 1.

The Barney & Smith Mfg. Co., of Dayton, O., have completed 16 passenger cars for the Mexican Central.

The Cincinnati, Washington & Baltimore has just received five passenger cars from the Litchfield (Ill.) Car & Machine Co.

The Colorado Midland has placed an order for 200 box cars.

The Chicago, St. Louis & Pittsburgh is reported to be in the market for 500 box cars, to be equipped with the Wagner car door, Janney coupler and Westinghouse air brake.

The Erie (Pa.) Car Works, Limited, are very busy completing an order for 250 freight cars for the Allegheny & Kinzua road, now building. It is the intention of the company to commence on repair work for the Pennsylvania this winter.

The Richmond & Danville this week placed in service the four new passeenger cars built by the Jackson & Sharp Co., of Wilmington, Del.

The Haskell & Barker Car Works, Michigan City, Ind., will build a blacksmith shop 130 by 164 ft.

The Baltimore & Ohio will build a new wood-working shop at Grafton, W Va.

The Southern Pacific has recently made large additions to its shops in Sacramento. A new machine shop, in connection with the car-building shop, has just been completed, and a large force of men is now engaged in building an addition to the locomotive shops, which will make them a third larger than at present.

The Wells & French Co., of Chicago, has been given an order for 500 freight cars for the Illinois Central.

Bridge Notes.

The Louisville Bridge Co. has been awarded the contract to build an iron bridge 135 ft. in length, across Straight Creek, near Pineville, Bell County, Ky.

The Kentucky Central has advertised for a new 217 ft. iron bridge to be built across Licking River on the line of the road.

Proposals will be received until Oct. 23 for the construction of a wrought-iron bridge over Hunt street, at Cincinnati, O., by Thomas G. Smith, President Board of Public Affairs.

The city council of Topeka, Kan., has ordered that an election be held on Nov. 6, for the purpose of voting upon a proposition to issue bonds to the amount of $300,000 for the construction of a new bridge across Kansas avenue. Engineers have examined the present bridge over the Kansas River and declare it to be positively dangerous.

A bridge is projected over the Missouri River at Yankton, Dak.

The County Commissioners will erect a $10,000 bridge at Indiana, Pa.

Eight thousand dollars has been voted for a new bridge over the Platte River at Columbus, Neb.

The new Central Viaduct in Cleveland, O., is approaching completion. It is being built by the King Iron Bridge & Manufacturing Co. The length of the Cuyahoga Valley portion of the bridge is 2,838 ft., its height above the river is 101 ft. and the span just put in place is 33 ft. above the Nickel-Plate tracks. The draw span over the river is 239 ft. long. The cantilever trusses are each 135 ft. in length and 20 ft. in depth, the long arm being 75 ft. and the short arm 30 ft. long. It will require another month to complete the ironwork.

A new iron bridge is to be built at Waterbury, Conn.

At a recent meeting of the Board of Aldermen of Boston, a communication from City Engineer Jackson as to the unsafe condition of the Federal street bridge was read. The City Engineer recommends that the fixed portions of the bridge be largely rebuilt and the draws replaced by new iron structures to be moved by steam-power, all the work to be done at once. Estimated cost is placed at $100,000.

The Mayor of Philadelphia has sent to the City Council a complete description of the preliminary plan of the proposed new Walnut street bridge. According to the plans, as submitted, the structure will cost $900,000, and it is proposed to decide the question at an early date, so that the preliminary operations may commence.

The Berlin Iron Bridge Co. has completed the iron superstructure for the bridge at Ansonia, Conn., but will not be able to put it in place for some time, as the abutments have not been finished.

The Groton Bridge Co. has completed an iron bridge across the Mohawk River at Frankfort, N. Y., and also one at West Schuyler, at an aggregate cost for iron work of $6,000. The towns of Newport and Fairfield are constructing a new iron bridge across the West Canada Creek at Middleville, for which they have issued bonds for $6,000.

The Central of New Jersey has now in the hands of Cofrode & Saylor's Philadelphia Bridge Works a contract for 5,000,000 lbs. of beams, girders, etc., to be used in the construction of its new handsome depot in Jersey City, and in the building of new bridges and replacing of old wooden or weak iron ones on the lines of the company. The road is also using a considerable quantity of new heavy steel rails to replace lighter ones and for renewals.

Manufacturing and Business.

The Safety Car Heating & Lighting Co. was incorporated Oct. 12 with a capital of $500,000. The trustees are Max Brickner and Abram Stettheimer, of Rochester, N. Y., and Adolph Broskowitz and Sigmond Steinhardt, of New York. Owing to increased business the Cleveland, Frog & Crossing Co. found it necessary to erect a more commodious shop, which it was thought would be amply large for some time to come. It was first occupied about July 1, and since that time the company have been obliged to constantly add tools of the most modern pattern to enable it to fill orders with dispatch. Orders have been so large and urgent that for six weeks past the company has been compelled to work night and day.

H. H. Mansfield, who was connected with Barrows & Co., of New York, for some years, has opened an office at 36 Pine street, New York, for railroad mill and manufacturers' supplies. He has been appointed New York Agent by Messrs. A. Whitney & Sons' Car Wheel Works, of Philadelphia, Pa.

The Powell Planer Co. has recently shipped the following planers: A 36 in. × 36 in. × 12 ft. double headed to the

Burton Stock Car Co. at Wichita, Kan.; a 30 in. × 30 in. × 8 ft. to a manufacturing concern at Corry, Pa., and a 24 in. × 24 in. × 6 ft. planer to New Haven, Conn., besides other smaller ones. The company has also completed an immense planer, with a bed 66 in. wide, for use at its own works.

The American Wire Nail Co., of Covington, Ky., has increased its capital from $100,000 to $300,000, and will add a rod mill of 100 tons capacity and a wire mill of 75 tons capacity, double turn. The works are to be completed by February.

The Anchor Iron Car Roofing Co., of East St. Louis, has been organized, with a capital stock of $50,000, by H. D. Sexton, Henry O'Hara and Royal J. Whitney.

Riehle Bros., proprietors of the Philadelphia Scale & Testing Machine Works, report the following sales: Cornwall Railroad, Lebanon, Pa., one 200-ton railroad track scale; Bethlehem Iron & Steel Co., Bethlehem, Pa., one 12,000-lb. rolling mill scale and one 2000-lb. wheelbarrow scale; Carbon Iron Co., Pittsburgh, Pa., one 100,000-lb. testing machine; Union Foundry, Pullman Car Wheel Works, Pullman, Ill., one 5,000-lb. foundry tester; H. Disstons & Sons, one 60-ton railroad track scale; Wm. Cramp Sons, one 60-ton railroad track scale; Cameron Coal & Iron Co., one 50-ton railroad track scale and one furnace charging scale; Robesonia Iron Co., Robesonia, Pa., one 50,000 lb. pig metal tester; Rockhill Iron & Coal Co., Robesonia, Pa., one furnace charging scale; Campbell Iron Co., Ironton, Ohio, one furnace charging scale; New Mineral Coal & Iron Co., Ivanhoe, Va., two pig metal trucks, one pig metal scale and one turn table; Pulaski Iron Co., Pulaski, Va., one miner scale; U. S. Government, Boston Navy Yard, one 200,000-lb. screw power test machine and one wire tester; Edison Electric Co., Philadelphia, two 20-ton wagon scales, and Drexel & Co., one coal hopper scale.

The Star Brass Manufacturing Co., of New York, has received the contract for gauges, engine registers and clocks for the engines of the steamer "Puritan," now being built by the W. & A. Fletcher Co., of New York, for the Old Colony Line. This company is also making a similar set of instruments for the new fire boat for the city of Boston.

The Knowlton Automatic Car Coupler Co. has recently been organized in Maine with $100,000 capital and the following officers: President, Hon. Hiram Knowlton, of Portland; Treasurer, Walter M. Lowney, of Boston; Secretary, William J. Knowlton, of Portland; Agent, Andrew J. Chase, of Portland. The Boston office will be at 103 Pearl street. The company owns two patent automatic couplers, one a jaw coupler and the other a link and hook coupler of simple construction.

The Kansas City Car & Wheel Co. has increased its capital stock from $100,000 to $250,000.

The Dunham Manufacturing Co., of Boston, has met with such success in the pressed steel stake pocket that it has doubled the capacity for making it, and is now able to fill all orders promptly.

The Westinghouse Electric Co. has leased the Consolidated Electric Light Co. and the Sawyer-Man Electric Co., and will hereafter conduct the business of these companies. This consolidation gives the Westinghouse Co. control of the lamp trade heretofore conducted under the Sawyer-Man patents, and as it is already a large stockholder in the Consolidated and Sawyer-Man companies, it will now be able to develop to the fullest extent its already large incandescent electric lighting business. With facilities for the manufacture of 7,500 lamps daily, its trade will be greatly enlarged by the superior quality of the lamps produced. The Westinghouse Co. has recently acquired improved processes for lamp-making, enabling it to obtain more light from a given expenditure of power than has ever been guaranteed by any other company, and, doubtless, these improvements, together with a reduced cost of manufacture, will be found to inure to the benefit of their customers in the way of reduced prices.

The Ohio Valley Improvement & Contract Co. has been organized at Louisville, Ky., for the purpose of constructing the Richmond, Nicholasville, Irvine & Beattyville Railroad. Judge A. E. Richards, Chief Attorney for the Louisville Southern, is President. The office is at Louisville, Ky.

T. William Harris & Co., 44 Broadway, New York, have been awarded the contract for extending the Dobbs Ferry and Hastings Gas Works. New pipes will be laid at both Dobbs Ferry and Hastings.

Iron and Steel.

At the annual meeting of the stockholders of the firm of Carnegie Bros. & Co., in Pittsburgh, this week, Henry Phipps, Jr., resigned his position of Chairman, and Vice-Chairman D. A. Stuart was elected Chairman; J. G. Leechman was elected Vice-Chairman. Mr. Phipps retains his interest in the firm, and retires from active duty for a period of rest. At a meeting of the stockholders of the firm of Carnegie, Phipps & Co., John Walker resigned Chairmanship and William L. Abbott was elected to succeed him; H. M. Curry was elected Vice-Chairman. Mr. Walker retains his business interest in the firm, but the cause for his retirement has not yet been announced. The latter firm has just completed at their Homestead works a casting for the 42-in. cylinder of the 3,000-ton shear in the slabbing mill. It will weigh 54,600 lbs. and will be a reverse casting.

Miller, Metcalf & Parkin, of Pittsburgh, Pa., will add to their works a department for the manufacture of common steel.

The Swindell Construction Co., of Pittsburgh, is remodeling the tube department of the Riverside Mill, at Wheeling, W. Va., for the use of manufactured gas. The other departments of the mill were originally constructed for the use of manufactured gas, the appliances for which will answer equally well for natural gas, while those of the tube department were made exclusively for natural gas, which necessitates a thorough overhauling and change in the furnaces before manufactured gas can be used.

The Jefferson Iron Works, of Steubenville, Ohio, will soon commence the erection of an additional blast furnace. It will probably measure 75 × 17 ft., and have a capacity of about 175 tons per day.

The partnership hitherto existing between Rees, Shook & Co., founders and machinists at Pittsburgh, has been dissolved by the retirement of Levi Shook and W. G. Wilmot. The business will be continued by the remaining partner, W. M. Rees, at No. 46 Water street, Pittsburgh.

The erection of a pipe works for the West Superior Steel Co., at Duluth, Minn., has been completed. The works have a capacity for producing 200 tons of cast-iron pipe daily. The foundation has already been laid for a blast furnace to have a capacity of 200 tons per day, work on which has been suspended until spring next year. At that time will also be commenced the erection of a Bessemer steel plant, for which Mr. James P. Witherow, of Pittsburgh, Pa., who has built the pipe works, has also the contract. The West Superior Steel Co. is composed largely of western railroad men, and when the buildings are completed, which will be during the summer of next year, the company will have one of the largest iron and steel manufacturing plants in the West.

The incorporators of the Globe Foundry at Wellston, Ohio, have purchased the foundry building recently erected by Spellacy Bros. and will at once equip and start it in operation, to manufacture supplies, such as cars, tools, etc., and make engines, machinery, etc.

The Springfield Iron Co., of Springfield, Ill., has opened an office in St. Louis, Room 164, Laclede Bldg., where they will be represented by Mr. Albert Waycott, formerly connected with the New York office, and also with the Troy Iron & Steel Co.

At a recent meeting of the stockholders of the Fall River Iron Works Co., it was voted to increase the capital stock from $96,000 to $1,400,000. This is believed to be preparatory to the erection of a large mill upon the old iron works property, which is now owned by the American Printing Co.

The Prospect Rolling Mill Co., of Cleveland, has started business in the old Crucible Steel Co.'s Works, near the Cleveland & Pittsburgh road. The company will manufacture all grades of bar iron and steel tires. The capacity of these works will be about 60 tons daily. There are six furnaces, and it is expected to have the works all in complete running order in 40 days.

The Keystone Rolling Mill Co., of Pittsburgh, is operating its plant double turn in all departments, except the plate mill, which is still idle.

It is reported that the Pennsylvania Steel Co., at Steelton, has had a favorable experience with the Archer fuel gas, and that 1,026 tons of steel were heated in one day with a consumption of only 3 gallons of oil per ton of steel.

The Briggs Iron & Tool Co., of Findlay, O., will erect a new forge building, 160 × 40. The new building will contain a 20-bar guide mill.

The Standard Tool Co., of Cleveland, O., is erecting new works on Garden street. The main building will be three stories high and 165 ft. long. There will be a separate boiler and engine house, also one-story office and warehouse, 85 × 32 ft. The company does not expect to occupy the new works until the beginning of the year.

The Cochrane Roller Mill Supply Co., of Dundas, Ont., is rapidly completing new works at Escanaba, Mich. The company will have its own foundry for making iron castings, and expects to employ nearly 1,000 men when in full operation.

Work on the new rolling mill at Bristol, Tenn., is progressing very satisfactorily and it is expected that it will be in operation by Jan. 1.

The 20-ton Lash open-hearth steel furnace which was erected some time ago for the Standard Steel Casting Co., at Thurlow, Pa., by Lean & Blair, of Pittsburgh, is working successfully with producer gas, making heats in seven hours. The erection of this furnace to run on producer gas was an experiment, as all other furnaces erected by Lean & Blair are running on natural gas. Messrs. Lean & Blair have recently opened a branch office at 168 Washington street, Chicago, under the management of J. H. Reed & Co.

The new Gadsden furnace of the Gadsden Alabama Iron Co., at Gadsden, goes into blast the present week.

The Denver & Rio Grande has an order at Chicago for about 5,000 tons of steel rails.

After a suspension of several months the steel mill of the Pottsville Iron & Steel Co. started up this week.

The Rail Market.

Steel Rails.—An order is said to have been placed by the Chicago, Burlington & Quincy with a Chicago firm for 20,000 tons and for 10,000 tons with a Pittsburgh firm. No large sales are reported in the east. The shipments to Oct. 1 were, according to the report of the Board of Control, 921,363 tons. The shipments last year to the same date were 1,390,825 tons.

The sales this year have been 1,134,883 tons, while last year they were 1,883,126 tons. Last year the sales for 1887 delivered were nearly as large on Jan. 1 of that year as they have been for 1888 delivery on Oct. 1, 1888. On Oct. 1, 1888, the total sales for 1889 delivery amounted to 40,000 tons. The outlook is therefore far from encouraging, especially as the great northwestern roads, which have been adding so largely to their mileage lately, have almost completed their great extensions. Quotations, $28@28.50 at Eastern mill.

Old Rails.—A lot of 1,000 tons, bought by an Eastern mill, is the only large sale reported. The price paid was $23.50, which is the nominal quotation.

Professor Lanza on Continuous Heating.

At a recent meeting of the Society of Arts at Boston, a lecture was given by Professor Lanza upon heating cars by steam from the locomotive. It was premised that the lecturer had conducted a series of experiments on railroads by appointment of the railroad commissioners of Massachusetts. Experiments showed that but a small percentage of the steam of the locomotive is required for heating. The pipe which carries the steam from the engine should be not less than 1½ in. diameter; the radiating pipe within the car should be of 2 in. diameter, the connecting pipes between car and car should be of rubber and not of metal, since the latter with whatever carefully made ball joints and slip joints will in service soon begin to leak steam at the joints; direct steam must be used, various plans of using exhaust steam having proved deficient, and moreover the waste steam being needed for draft for the boiler fire; and couplings between cars that uncouple automatically are much preferable.

The chief practical difficulty that is met is in providing a proper trap for discharging the condensation water. The difficulty which would naturally first arise of devising a trap that will not leak steam when there is no water collected, and which will automatically open to receive water when it accumulates, has been overcome by two ingenious methods, which the lecturer explained.

The main trouble consists in the liability of the traps to freeze up when the cars are not in use. Even if the condensation water be fully drawn off when the cars are housed, there is still drip and moisture enough to freeze the interior parts of the trap together. The remedy adopted has been to maintain steam in the pipes when the cars are housed in cold weather. This is done either by a stationary engine in the car house, or by a locomotive detailed to stand in the car house for the purpose.

The Wheeling Bridge.

Work was begun Oct. 9 by the Wheeling & Harrisburg Railroad on the union railroad bridge over the Ohio River at the north end of Wheeling, and also in East Wheeling on the terminal system to reach all the roads centring there. The bridge will be 2,100 ft. long, double track. The channel span is 535 ft. Gustav Lindenthal, of Pittsburgh, is the engineer of the bridge. It is expected that the bridge and approaches will be completed by January, 1890. The terminals include a tunnel 1,600 ft. long and a bridge over Wheeling Creek, and will cost, when completed, several million dollars. Wheeling subscribed $300,000 to the bridge stock.

High Speed.

J. B. Barnes (Superintendent of Motive Power, Wabash), is stated to have recently expressed himself to an interviewer as follows: The surprising feats of fast running recently made by railroad trains has prompted an interesting discussion in the newspapers and in railroad circles, of what may be the possible limit of speed at which a railway locomotive may be made to travel. Theoretically there is no limit, practically there is; but that practical limit is surely not within 100 miles an hour. I hold that speed can be attained if the machinery and the track be sufficiently improved, and by means that locomotive builders and railroad men well understand. In the first place the engines would have to be of the compound construction, and the drivers would have to be at least 8 ft. in diameter. But no attempt, I apprehend, will ever be made to run passenger trains at such a frightful speed. It would involve a revolution of railroading so complete and radical as to make the idea preposterous. Besides, it is doubtful whether passengers would be found willing to outride the gales; or engineers could be found cool enough to be intrusted with the management of locomotives on such trips. Still, we cannot say what will happen. Not long ago we used to consider 60 miles an hour a pretty good pace on the Wabash, but we are now running 75 and even 80 miles an hour in spurts. One evening last week engine No. 1,571 pulled express train No. 42, made up of eight heavy day coaches and sleepers, out of East St. Louis at the rate of 72 miles an hour, and this pace was kept up for 11 miles. I have myself driven locomotive 1,051 at the rate of 73 miles an hour. Superintendent Stevens was on the train and timed me. The question is beginning to resolve itself into this: "Not how fast can passengers be pulled, but how fast dare we ask them to ride?"

Aluminum.

In a lecture before the Franklin Institute, Prof. Hanford Henderson stated that aluminum was an element whose name is to-day in almost everybody's mouth, but in different mouths it has taken different forms. From some we hear of it as aluminum, while others are always careful to say aluminium. On grounds of both euphony and historic usage the longer name has, he thinks, decidedly the preference.

There is about 40 per cent. oxide of aluminum in ordinary clay and about 56 per cent. of metal in the oxide, so that a cubic yard of clay contains about 937 lbs. of metallic aluminum. At $5 per lb., the lowest, this is worth over $4,500, and consequently one cubic yard of ordinary pure clay contains an amount of aluminum for which society is willing to pay over $4,500.

The globe, taken as a whole, is between five and six times as heavy as water, while the rocks open to our study are only about two and a half to three times as heavy as that standard, we may not unreasonably suppose the core to be composed of the heavier metals, iron, lead, zinc, perhaps silver, gold and platinum. Of the composition of the surface of the earth, however, we have more definite information. Oxygen, the gas upon which life itself depends, makes up about one-half of these rocks; silicon, the basis of ordinary sand, about one-fourth, while aluminum stands third quantitatively in our recognized list of seventy odd elements. And not only is there a great deal of it in absolute quantity, but the forms in which it occurs in nature are also correspondingly numerous.

Mineralogists have described and named nearly 1,000 different minerals. In more than 200 of these, aluminum occurs as an essential constituent. There is scarcely a gem mineral, outside of the diamond and the rock crystal, that does not contain aluminum. The brilliant sapphire, the oriental ruby, the oriental topaz and the commoner form, corundum, are oxides of the metal. Add a little iron to this, and we have the valuable abrading material known as emery. The real ruby and the much-prized gem, alexandrite, are compound oxides of the metal. Among the silicates it occurs in nearly all the known varieties, from the common clays and other rock-forming aggregates to such royal gems as the emerald, the garnet, the lapis lazuli, the party-colored tourmalines and the topaz. As a hydrous phosphate, it give us the turquois, one of the most beautiful among the mineral blues.

Mr. H. Pemberton, Jr., in a more recent lecture, stated that the principal use of aluminum would be as a material for alloys, the pure metal, though lighter than steel, had proportionately less tensile strength per unit of area, and therefore would probably never be used for large structures as some supposed. A small addition of aluminum, however, lowered the melting point of some metals, such as iron, and alloys with tin and copper gave metal of unequaled strength.

Aluminum will probably be used almost universally in the metallurgy of steel and of iron, including puddled iron. Its strength-giving properties are extraordinary. There is hardly any metal with which it will not alloy. And it alloys with nothing that it does not improve.

The Basic Steel Suits.

Mr. Justice Green, of the Supreme Court, in an opinion delivered at Pittsburgh dismissed the appeal of Jacob Reese from the decision of the lower court, directing him to deliver up to the Bessemer Steel Co. certain patents covering the manufacture of basic steel. Justice Green says: "The chief contention of the parties to this litigation is upon the terms of their contract relation. That relation is evidenced by four distinct writings. The Court below held that all the inventions relating to the manufacture of iron or steel into rails, ingots or billets, metallurgy of iron or steel were included. Mr. Reese contended that the Court erred in holding that any inventions not patented or applied for at the date of the contract were included in its operation.

"We are clear that when Mr. Reese stipulated in his letters that he would sell or assign the exclusive right to use all and every patent either granted or applied for, together with all renewals, reissues or improvements of the same which can be used or relate or apply in any way to the Bessemer or pneumatic process in the United States, he undertook to transfer whatever inventions he had then made relating to the Bessemer or pneumatic process, whether he had at that time obtained patents therefor or applied for them or not. It seems to us that good faith requires this interpretation, otherwise he could hold back important inventions, which, in point of fact, were improvements upon patents then issued or for which applications were then made, and by incorporating them into subsequent patents or applications use them to the injury of the Bessemer Co. We are of the opinion that the case was rightly decided by the Court below."

This decision throws the complete control of basic steel manufacturing into the hands of the Bessemer Steel Co., a syndicate which bought the Thomas-Gilchrist patents for basic steel, unless the Pratt process for dephosphorization proves successful.

Large Pontoon Bridge.

The pontoon bridge over the Missouri River, at Nebraska City, is said to be the longest in the world. Its length across the navigable channel is 1,074 ft., while the back channel is traversed by a causeway 1,050 ft. long, supported on cribs. The charter for this bridge has been held for twelve years, because of the difficulty of obtaining financial support for a project which appeared so impracticable. It is stated that the entire bridge was built in twenty-eight days, at a cost not exceeding $18,000, by Col. S. N. Stewart, of Philadelphia, assisted by Gen. Lyman Banks, of Iowa. The draw is V-shaped, with the apex down stream. It is operated by the current and controlled by one man. The clear span is 528 ft. The bridge was completed in August and is doing good service. It will be removed during the ice season.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

In commenting upon the decision of the Inter-state Commerce Commission in the Standard Oil cases, in our issue of March 2, we indorsed some of the criticisms of the Commission upon the traffic department of the Illinois Central. The company has just brought to our notice facts which indicate that we have done it some injustice. It looks as if the severest criticisms of the Commission were based on a misquotation of an important piece of evidence. The matter is so serious that we prefer not to go into details until we have had the opportunity for fuller investigation. If it proves that we were misled as to the facts, we shall certainly try to do the company such justice as is possible.

Not all of the official reports of accidents come from England. Train troubles happening in this country occasionally get investigated by disinterested parties, especially when there is a falling out somewhere. At Armstrong, Neb., a Chicago, Kansas & Nebraska freight train switching on the Union Pacific track was run into by a train of empty passenger cars that approached on the latter road. The companies disagreed as to the apportionment of the expense of the collision and asked the State Railroad Commissioners to decide the question. The collision happened at 4 o'clock on a foggy morning. The switching train was 825 ft. within the yard limits and had a man out with a red light, but he had no torpedoes and the testimony is conflicting as to how far he went. The C., K. & N. defended the non-use of torpedoes by quoting the phrase of the rule reading, "in case of accident or detention of a train on the main track between stations, the brakeman must go back," etc., and the brakeman says he sought for torpedoes on the flagstaff but found none. The Union Pacific rules require all trains to "pass over switches and through stations with greet caution, expecting to find occasion to stop," but the force of the collision drove the U. P. engine's tender into the car behind it, though the C., K. & N. train was standing still, and the commissioners therefore find that the U. P. runner was not properly cautious, considering that it was a foggy morning. This, in connection with the negligence concerning torpedoes, leads them to decide that each road must bear its own loss, neither being liable for the damage to the other. The defense offered in this case for the non-use of torpedoes recalls a point in connection with the Uniform Code. Rule 99 of that code reads: "When a train is stopped *by an accident or obstruction* the flagman must go back," etc. This is the most important of the flagging rules, and is likely to be quite well fixed in the minds of some brakemen who will not be at all clear concerning the intricacies of the modifying and explanatory rules. It should therefore be made as strong as possible. Explaining the reason for stoppage is not an essential part of the rule, and therefore tends to weaken it; in fact, brakemen used to be threatened with dire penalties if they allowed themselves to take an interest in this question. The word "obstruction" may be misconstrued. Anything that stops the train is an obstruction, even if it be nothing more than a "frog on the track," but at first thought the meaning seems different. A little confusion on this point may lead to a fatal blunder some time.

The Present Use of Continuous Heating.

As winter approaches, there is renewed interest in the subject of train heating, and we have endeavored to get information from the railroad companies showing the extent to which systems of continuous heating have been definitely *adopted* for use, and of the amount of passenger equipment that will be fitted with any of the various heating systems for this season's business. Information is received from 137 different lines having a mileage of over 45,000 miles, and a passenger equipment of about 8,000 cars, including baggage, mail and express cars, which must be fitted with train pipe and couplings if not with radiating pipes. Out of these roads 24 appear to have adopted some system of continuous heating definitively, and are in course of fitting all of their cars for it. Besides these, 19 roads are carrying on experiments. Of this latter class there are known to be several more which have made no report of what they are doing, and among these are some important lines. The figures do not cover the elevated roads, where the conditions are peculiar, and where continuous heating has long been in general and successful use. For the surface roads they are undoubtedly pretty complete.

The lines which report having adopted a continuous heating system have fitted now or shortly will have some 2,500 cars. The cars fitted by the other lines for experimental purposes are, of course, relatively few.

A canvass of this same subject made last December showed that only some five or six roads had *adopted* any system of continuous heating, and it was estimated that there were less than 800 cars fitted, aside from those of the Manhattan Elevated. It is seen, therefore, that the progress in the year has been important, notwithstanding the pretty general feeling that the subject was still too new and the mechanical details still too imperfectly worked out to warrant final action. It cannot be said that the progress made the last year has been entirely on the merits of the system irrespective of other considerations, for the pressure of state legislation has been of some effect, yet too much importance might be given to that influence on a casual inspection of the returns, for we find that out of the 24 companies, 14, which have adopted the Martin system, run in the state of New York, or stand in such relations to the New York Central that their action would be greatly influenced by the action of that road. Other New York roads have adopted the McElroy and the Gold, and the Fitchburgh, which runs into the state, has adopted, or at least is largely using, the Sewall. If it were true that the law of the state of New York had been the chief influence in causing continuous heating to be used in that state, the action of most of the 24 roads would be thus accounted for. This result has been hastened by that law undoubtedly, but we do not regard it as the chief element. The New York Central as a matter of fact made experiments in this method of train heating eight years ago, before there was any state action, and they took up the matter again later, largely for business reasons,—that is, as a measure of safety, economy and popularity. The experience with steam heat in the "blizzard" of last March convinced them of its superiority in the most trying condition. The Lake Shore and the Michigan Central, using the Martin system, have naturally been in close relations with the New York Central in this matter, and through them the legislation of the state of New York, so far as it has been felt at all, has had an influence far beyond its borders. The action of the Delaware & Hudson Canal Co. in adopting the McElroy system, and of the Delaware, Lackawanna & Western in adopting the Gold, was doubtless hastened by legislation, but it may be assumed that the successful use of steam on a neighboring road was an important factor in determining their course. The Maine Central and other northeastern roads have used the Sewell for some years on its merits, entirely uninfluenced by state action.

It is true that in the West, leaving out the roads which would naturally act in common with the New York Central, continuous heating has in few cases passed beyond the experimental stage. In those cases, however, legislation does not appear to have been the active stimulus. The Chicago, Milwaukee & St. Paul and the Milwaukee & Northern have adopted the system devised by Mr. Gibbs, of the former road, which endured a pretty thorough trial last year. In this system the train pipe is carried overhead and rational provision is made for ventilating as well as for heating. So far as can be judged, the action of these companies has been taken entirely independently of any apprehended legislation. The Burlington, Cedar Rapids & Northern has adopted a system of continuous heating of its own design, for all of its passenger equipment. The Atchison, Topeka & Santa Fe is very active in this matter, and the Rock Island, without having adopted any system, is "now equipping a large number of cars and engines" with the Sewall system. Presumably these roads have been governed entirely by business considerations in what they have done in this way.

As we have said, the actual progress of the continuous heating system during the year has been important, but relatively to what remains to be done it seems insignificant. The question is raised whether the railroads have gone ahead as fast as, in wisdom, they should have done. Probably they have, considering the light that they had. For the last two years many experiments with many different systems have gone on in various parts of the country, and the mechanical officers of the railroads have been entirely satisfied with no one system in all of its details. Changes in detail have been repeatedly made in the systems most widely used. The information collected by the Master Car-Builders' Committee last summer showed that there was yet no agreement as to the best method of piping, as to whether or not traps were necessary or even useful, as to methods of regulating temperature and as to other details; and whoever will read the report on another page of the hearing before the New York Railroad Commission will see that there is still a fundamental disagreement as to whether the metallic or flexible hose connection is the better, to say nothing of agreement upon the details of couplings used with either type. There is not even general agreement that the continuous heating system offers that entire security which is claimed for it. One well-known and distinguished General Manager writes: "I am aware that the American mind has been fully aroused on this subject, because something like 2 per cent. of fatal accidents occurring on railroads for the last 10 years have resulted in death by burning. But before deciding what we shall do I propose to wait until we find an American citizen who will be able to convince me that being scalded to death with steam under a pressure of from 20 to 30 lbs. per sq. in. is more agreeable than to be burned to death. I consider the whole matter to be still involved in great doubt and obscurity." Whatever one may think of the danger of scalding from steam escaping from heating pipes (and that danger cannot be very serious), it must be admitted that the whole problem has, till within a few months, bristled with doubtful points. It must be remembered, also, that the question has not been between subjecting passengers to great peril and relieving them from it, for there are, as a matter of fact, independent heaters now in use which afford almost complete security from fire. The conditions, therefore, being as they are, it is not surprising that the great majority of the railroad companies have chosen either to experiment carefully or to watch the experience of their more enterprising or richer neighbors, and we must say that they have been wise in their choice.

Moreover, we think that even now legislation to compel immediate adoption of continuous heating would work more harm than good. The experiments are progressing steadily under natural influences, and the experience of the next winter will be far greater and more valuable than all that has been obtained before. Last winter killed off several promising inventions, and another winter will settle many points now in doubt, and the railroads will be able to choose with knowledge and discrimination. Eventually the progress of continuous heating will be the faster for being started right. It will go steadily forward on its own merits from this time. Of course, the greater safety of this method of heating will be the first consideration, but there are others which will take on greater importance in the future. It will pretty certainly be found cheaper than heating by stoves or any form of independent heater. It is cleaner also, and is well adapted for use with some thorough system of ventilation. Roads which have to compete for passenger business, as nearly all roads do, will find steam heating one of their most attractive inducements. As the art of heating trains by steam from the locomotive grows, and knowledge of its real merits spreads, the use of the method will

increase naturally, and, it is hoped, fast enough, without the artificial and doubtful stimulus of legislation.

The Mud Run Disaster.

This tragedy ranks with Chatsworth and Ashtabula, except in the number of victims, and nearly equals them in that particular. The scalding steam apparently worked as terrible havoc as could be expected to result from fire. Unlike Ashtabula and Chatsworth, this collision was the direct result of a common kind of negligence, and that on the part of several persons. Collisions of *freight* trains from causes similar to those that operated here are happening every month.

Inquiry naturally turns to the apportionment of the blame for the present and to ways of prevention for the future. The testimony before the coroner's jury and evidence gleaned from other quarters is somewhat contradictory, and a final verdict is perhaps not warranted at this distance and at this time, but there seems little doubt that the lookout on the engines was very faulty, and that this was the immediate cause of the disaster. The utterances of the daily press are of the usual tone, evincing the blindest reasoning, and are specially severe on the managers of the road; though in point of fact the Lehigh Valley management is conspicuous among railroad managements for conscientiousness and intelligence, and in many of its relations to the public is noted for its alertness to meet all requirements. The terms of the order issued to trainmen for the special traffic of the day of the excursion evince carefulness and forethought. Extra men were placed on each engine, so that the fireman's duties at the fire-box should not prevent a good lookout being kept. From all that appears thus far the fault of the trainmen as compared with that of the superintendent or other manager is greater than is usually the case.

The strength of the cars that were crushed, while not up to the best present standards, may probably be classed as fair, so that the trainmen's estimate of the speed (10 or 12 miles an hour) must be regarded as far too low. Good judges say that the train must have been running at 25 miles an hour when it struck, and various circumstances corroborate this view. The foremost colliding engine was a new freight engine, and was therefore heavy, no doubt. The brake power of the cars may have been of any degree of efficiency, from poor to very good, but of this we have no information. The fatal certainties of the case are, however, sufficient to account for the disaster. 1. The brakeman, though avowedly on the track for the purpose of stopping the train, took no pains to swing his light until he saw danger imminent. He did not go far enough to make his signal of any special value. It simply reinforced the station signal. The injunction of the special order, "Protect your rear," was the most indefinite and unmeaning paragraph in the whole circular. Whatever may have been the standing rule about going back half a mile, the *practice* on the road very likely warranted him in stopping when he had reached a point where his red light could be *seen* 1,600 ft. back, and where all trains must be run under control. The share of blame attaching to this man is, therefore, not clear, from present information. 2. The station agent or operator, though in a situation to fulfill most of the functions of a block signal operator, and doubtless expected by all concerned to so act, displayed an all-clear signal, which induced one of the engineers to signal "off brakes," and thus lead all on the train to relax vigilance. Whether the superintendent expected the station-man to let his elevated train-order signal remain at white, and hold the trains with a hand lamp two or three feet from the ground does not appear. 3. The lookout man on the left-hand side of the leading engine was not sufficiently familiar with his duties to scent danger the moment he saw a red light. By his own testimony, as reported, he failed to warn the runner for some seconds after he plainly saw a red light at the station. From certain portions of the evidence we conclude that the boiler and fire-box filled the bulk of the cab (of both engines) so that the runner could not cross over to the left side of the engine and look for himself. Of course, the discipline which trains enginemen and firemen to always slacken at once for a red light (even if it is not directly before them), and brakemen to always hide danger signals from those whom it is not intended to govern by them is hard to maintain and often is wanting. How it is on this road we do not know. 4. The leading engineman had no control over the air brake and the runner of the other had had no experience in running passenger trains. This is the point on which railroad men will most severely criticise the management. Some experienced officers object to "double headers" for various reasons, and others who approve them do it only on condition that the leading engineer can control the train brake. This question was brought forcibly to the attention of railroad men in the collision at Carlyon, N. Y., on the Rome, Watertown & Ogdensburg, July 27, 1883, and its importance was clearly stated in the report of the New York Commissioners on that accident.

For the future, managers will probably turn more zealously than heretofore to the block system. The negligence of trainmen exhibited in this case is such as can be corrected only by the most careful and wide-reaching plans, patiently carried out. To readers of the *Railroad Gazette* the directions in which this improved discipline should be aimed need not be recounted here. The long (or at least very irregular) hours of work apparently had no serious influence in this case, but there is no telling what their hidden bearing may have been, and the conscientious superintendent cannot ignore the warning. The question of brake connections, being happily unaffected by the ordinary financial objections, can be settled quickly if once taken up. The most earnest thought will therefore be given to the question of blocking.

The block system has remained unused chiefly because of its expensiveness and the belief that nothing but a costly plant of special towers, located very close together, manned by signalmen for 24 hours a day, would afford a satisfactory service. But, as readers of the *Railroad Gazette* are aware, the principle has been applied for several years on a scale less elaborate than this, and with a good degree of satisfaction. It is used by experienced and careful superintendents, who cannot afford to equip short blocks, who cannot afford special men for it in every case, and who have to close a portion of the offices during the night. One road which uses the system with great satisfaction has blocks 20 miles long during the night. Enterprising superintendents, who have not as yet gone as far as they would like to, use it with satisfaction on special occasions, as protracted seasons of foggy weather.

It is to be remembered that the block system will not work without intelligent attention and supervision, and the experience of the roads in England and America that have used it longest teach us not to expect impossibilities of it; but the record of rear collisions in this country imperatively demands that something be done. Mere financial questions, setting aside humanity, make the problem of vital importance to superintendents, and if progress in enforcing better obedience to present systems is deemed discouraging, greater attention to the experience of those who have varied the system is the least that can be done. It may be said that the trainmen who blundered so terribly at Mud Run might have neutralized the best system; but if they had been for years in the habit of expecting a fixed signal at this place and of always finding it in exactly the same position (locality), the probability of a mistake would have been immensely reduced, to say the least. More leeway than two rail-lengths would doubtless have been allowed if a regular block system had been in use. An occasion like the Hazleton celebration would be just the time when officers would be tempted to relax the requirements of a safe system, as we learned at Hexthorpe, England, a year ago; but the Lehigh Valley officers seem to have been fully awake to this consideration. A well-known manager who has operated the block system for several years, and who does *not* belong on the wealthiest of roads, affirms it as his conviction that any road, whether single track or double, that runs 24 trains each way daily should have a block system, and can afford it if it can afford to run its trains at all. The Canadian Pacific, whose President is a technical railroad man of high reputation, uses the system for a lighter traffic than this.

The Cost of Rebuilding Locomotives.

The question whether locomotives can be built as cheaply by a railroad as by a contractor is an old one and has been repeatedly discussed. It is generally conceded that modern locomotives can only be built to the best advantage where certain favorable conditions prevail. The output of the shop must equal at least 100 new locomotives per annum, the parts of a majority of the engines must be interchangeable, and special tools must be used. These conditions may be found on a large railroad where a considerable number of engines are exactly alike and interchangeable, and where those of different classes have many parts in common. The number of engines being large, special tools can be provided, and the work can be divided among a large number of men, each of whom becomes a specialist in his own particular department. In this way not only is the quantity of the work augmented, but the quality is generally greatly improved. This is well understood, and is probably one reason why large locomotive shops have continued to grow larger, while small shops have gradually dwindled.

It is a trite remark that figures require to be carefully handled if the deductions are to be of any value, and this remark applies with considerable force to any case of the relative cost of building locomotives in contract and railroad shops.

The Ohio & Mississippi locomotive illustrated on another page appears to have cost $4,500, while a similar engine could not be bought from a builder for less than, say, $8,500. The real difference in price is, however, nothing like $4,000. The gross cost of the rebuilt engine is set down at $5,900, less $1,400, the value of the parts of the old engine not used. Now it is obvious that if a new engine had been bought, the old boiler, cab, tender tank, etc., would have been equally available, and, indeed, the old frame, rewelded and used in the new engine, could have been sold for scrap, and with other parts raised the value of the old engine to, say, $1,500. The net cost of the new engine bought from a contractor would therefore be $7,000. On the other hand, the gross cost of the rebuilt engine as given only includes labor and materials. A fair allowance for incidental and indirect expenses, such as cost of patterns, gauges and templates; interest on and repairs of buildings and plant; coal, oil and stores used in running stationary engine, steam hammers and smith's fires; proportion of wages of foremen, clerks and draftsmen, and many similar items may be estimated at fully 25 per cent. on the bare cost of materials and labor. This allowance would increase the gross cost of the engine to $7,375. The indirect expenses should be similarly charged against the boiler, tank, etc., utilized from the old engine. This is evident, as these parts could not be utilized or even detached from the old engine without the assistance and use of the plant and shop tools, time of foremen, etc. Allowing that 15 per cent. of the total value of the old boiler was due to these indirect services, the deduction to be made from the sum which would be realized by the sale of the old boiler, etc., is $210. In other words, as this $210 represents cost that cannot be directly charged, it has to be deducted from the selling value of the old boiler, if we wish to ascertain its net value, which is consequently $1,190. The account therefore stands as follows:

Cost of Rebuilt Locomotive.

Labor and materials	$5,900	
Use of plant, etc	1,475	
		$7,375
Less selling value of old engine	1,400	
Less use of plant, etc	210	
		1,190
Net cost new engine		$6,185

Cost of Contract-built Locomotive.

New locomotive		$8,500
Less selling value old parts	$1,500	
Less use of plant, etc	225	
		1,275
Net cost new engine		$7,225

The difference in cost is consequently about $1,000 instead of $4,000. It is, however, frequently the case that in a railroad shop, time and materials employed in building a new engine are erroneously charged to repairs, and allowing for this and the fact that some old parts were used in the Ohio & Mississippi engine, it seems very possible that the actual difference in cost was less than $1,000. If, however, the difference is $500 or even $100, it reflects great credit on the management of a shop that is confessedly imperfectly supplied with tools and appliances for turning out work cheaply and quickly.

Principles Governing Railroad Rates.

Of the various arguments in the car-load rate cases that of Mr. Thomas L. Greene will probably have the most general interest for railroad men. It deals less with legal traditions and more with practical questions of traffic economy. Much of it is thoroughly sound; all of it is of special value as dealing with the subject from a standpoint different from that of the traffic manager, but with an understanding of the business conditions under which such a manager labors.

Mr. Greene begins by rejecting the cost of service theory as a basis of rates. The attempts to account in this way for differences in charge between large and small shipments are in his opinion wrong, because cost of service is not the actual basis of railroad tariffs. In this we believe that he is thoroughly right. We shall show presently in what respect differences in cost may have an important effect in determining the general policy of a road with regard to its schedule of charges; but they are not the first thing to be considered. The attitude taken by the

courts, in not readily allowing a difference of charge unless there could be shown to be some corresponding difference in cost, has made the railroad men prone to justify their schedules on this ground. But it is none the less an unsound one; and one which must react against the railroads themselves, in the long run, if they give it more weight in their arguments than they are willing to do in their practice. For instance, one ground on which some of the witnesses justified a higher charge for business in small lots was the greater cost of handling at the piers in New York City, and they even entered into calculations as to the interest charges on the cost of the piers, and the proportion of such charges which the parcel business ought to bear. Now, Mr. Greene is perfectly right in objecting that fixed charges of this kind are not a direct element in rates, and that it is not fair to attempt any such direct apportionment. Railroad men do not do it on other lines of business, and they ought not to do it here.

In point of fact, as Mr. Greene says, rates are primarily based on commercial conditions. The railroads cannot afford to make rates on any traffic so high as to destroy that traffic altogether. They arrange their charges to develop business; and consider cost of service only as an incidental factor, even though it be a most important one. Accepting this state of things as true, he contends that under the existing system of differences in rates the small shipper at the seaboard, who ships parcels direct, cannot compete with the Western jobber, who gets his goods in car loads; that he will thereby be forced out of business and that the railroads by thus destroying one important element in their trade will violate their own fundamental principle in making rates. "The reason assigned for varying rates," he says, "namely the competition of markets, is a good one if properly applied," and he insists that the present schedule is radically wrong, not on account of detailed questions of cost, but because the New York shipper is unable under the existing system, to compete with the jobber at interior points in supplying the small localities in the West.

His proof is interesting. He takes a number of articles commonly handled in the grocer's trade and gives a table first showing their value, next the gross jobbing profit, and finally the expenses of the jobber. The difference between the two last constitutes the net jobbing profit to the New York shipper. This profit is found in many cases to be less than the difference between car-load and less than car-load rates from New York to interior points. What will be the effect of such a state of things? It must almost inevitably drive the New York jobber out of the interior business. "It is only necessary for the home (*i. e.* interior) jobber to put his prices just a little lower than the New York price, *plus* the difference in freights, to shut out the retailer's power of buying at any distant market." This seems thoroughly clear. Whatever disturbing elements come in to effect the argument favor the Western rather than the Eastern jobber. The expenses of the latter are, on the whole, greater; his margin of profits, owing to more intense competition, is lower. The practical effect of the present differences must be, in the long run, greatly to restrict, if not altogether to destroy, the business of jobbers at the seaboard points in favor of those at interior trade centres.

Thus far the argument seems strong. Mr. Greene has given full and fair weight to the facts with which he deals, as elicited in the testimony, but he has omitted to consider some other principles which may seriously affect the cogency of his argument. We do not say that they destroy its force, but they seriously modify it.

It is true that the main element which determines the railroads in their system of rates is the effort to develop business, and that, in order that business of any kind may develop, it must be put on an equality with its competitors. But it is not true that the railroads actually develop all kinds of business equally, nor that they are under any obligation to do so. If a milk producer at a distance of five hundred miles from New York were to demand that he should receive exactly the same rates as those nearer home, because that was the only way in which it would be possible for him to ship milk for the New York market, the claim would obviously be an absurd one. It is true that in order to develop the business, milk rates are made substantially equal as far as they go; but there is a point beyond which this equality cannot be carried, a point where the additional business thus developed becomes distinctly unprofitable. Up to a distance of 150 miles, more or less, milk rates are made independent of distance as a means of securing the necessary volume of traffic. Beyond that point the traffic itself becomes unprofitable, and the railroads cannot wisely or rightly be compelled to make rates to secure it. It is in this way that the question of cost limits the application of the competitive principle in rate making. To develop their volume of business, railroads make their rates more nearly equal than would be indicated by a mere examination of the differences of cost of handling individual shipments; but there is a point beyond which this equalizing process cannot go without actual loss to the railroads.

It is in this way that cost of service comes into the question. If it be true that parcel shipments of the jobber at the seaboard are much more expensive to handle than the car-load lots of large interior points, then it is more than questionable whether Mr. Greene's argument holds good. Any enforced equality under such conditions means that the railroads and the community must do their transportation business in a less economical fashion than would be otherwise possible. Such an attempt cannot be made without loss. The rights of the New York shipper to be put on an equality with his Western competitor in supplying local points in the interior are subordinate, and must be subordinate to the public right of having the business organized in the most economical manner.

Looked at in this light, the car-load rate problem is but another aspect of the same difficulty which appears in the relations between long and short haul charges. The railroads may, perhaps, fairly contend in the one case as in the other that it is good economy for them and for the community to have their through business grouped into masses and to have it separated as far as possible from the business of local distribution. The practice of other countries in these respects, which Mr. Greene sets aside as irrelevant, has an immediate bearing on the case; the more so since those countries which have nearly abolished discrimination in favor of trade centres have continued on the very largest scale the discrimination in favor of car loads. The fact that they have indirectly done by their car-load charges what they attempted to prohibit by their schedules of local rates is a strong indication that some such difference in treatment between massed business and detailed business, if we may use these terms, was necessary in the interests of good economy.

It would be unjust to Mr. Greene to imply that he overlooked this point altogether. He attempts to prove that the constant supply of local business from the seaboard direct to small points at the interior is a steadier source of traffic and income to railroads than the comparatively few car-load shipments of groceries which they may receive. As far as he shows this, it has a most important bearing on the question at issue, but he does not seem to us to have fully covered this point. While tolerably constant in volume, such business is irregular in the methods of handling which it involves. Any one familiar with the conditions under which local and through freight trains are run knows how great is the added cost of the miscellaneous shipments, and how small a proportion of it is due to terminal expenses solely. Any theory of rates which should assume that the group shipments and the miscellaneous shipments stood on nearly the same level in the matter of railroad economy, would do positive violence to the facts. For that reason it may be good public economy as well as good railroad economy to adopt a policy by which one class of traffic is developed at the expense of the other.

As we look at the whole matter it stands practically in this way. The New York parcel shippers have at best only a *prima facie* claim to be put on the same level with their Western competitors in supplying the Western market. If it can be proved that there are such general differences in the cost of handling the traffic that it is better policy to develop one line of business than the other, Mr. Greene's argument loses most of its force. This point presented in this form has not been fully covered by the arguments on either side; and the efforts to make cost of service a direct standard of rates has confused the subject instead of clearing it up. We believe that enough has been shown to prove that these differences have been carried to an unwise and unjustifiable extent in many cases; on the other hand, we do not believe that it will be possible to do away with them to the extent demanded by some of the complainants. But whatever the final outcome of the case, an argument like Mr. Greene's will do much toward putting things on their true grounds; and we commend it most earnestly to the attention of traffic managers and classification committees.

High Speed and Heavy Trains.

The subject of "Quick Journeys and Fast Running," discussed at the last monthly meeting of the New England Railroad Club, is one that has always excited a good deal of interest. Most of the speakers dwelt upon the importance of maintaining a steady speed for a long distance, and rightly contended that this was a better means of a making a quick journey than the too usual method of running at an excessive speed for a few miles and then slackening for grade crossings and other dangerous points unprotected by efficient signals. The importance of providing signals and as far as possible abolishing grade crossings was urged by many of those present. This reform has been often advocated in these pages, and the high speeds attained so generally on the crowded lines of Great Britain show that the need for slackening can be practically abolished by the use of good signals and a very high degree of safety against collisions attained.

Exception may, however, be taken to one or two points raised at the meeting. The weight of ordinary English cars per passenger carried is not the same as in this country, as stated at the meeting: but, on the contrary, the great difference in weight is one of the fundamental difficulties in attaining English speeds here. An ordinary English third class car, by which 87 per cent. of the passengers travel, weighs about 25,000 lbs., and seats 50 passengers, whereas an ordinary American day coach weighs 50,000 lbs., and seats about 56 passengers. The standard Pennsylvania car weighs 42,000 lbs. and seats 52 passengers. These figures show that an American car weighs nearly twice as much as an English car, and seats but few more passengers. The difference is due to the greater height and width of the American car and the space occupied by the saloon, stove, aisles and platforms. If this space was occupied by seats, as in European cars, the seating capacity would be increased nearly 60 per cent., and consequently the difference in weight per passenger would be very small.

The European car, in proportion to weight, has larger wheels, springs, axles and journal-boxes, but any increase of dead weight from these causes is offset by the saving effected by dispensing with the truck. On some English roads, where long compartment cars on trucks are used, the weight per passenger is not greatly different from that usual here, varying from about 700 to 900 lbs. The difference in weight is also perceptible when parlor cars and their English prototype, first-class carriages, are compared. A Pennsylvania parlor car, weighing 67,000 lbs., accommodates 37 passengers, giving a weight of 1,811 lbs. per passenger, while an English car, such as that illustrated in the Car-Builders' Dictionary, weighs about 29,000 lbs., and accomodates 24 passengers, or 1,208 lbs. per passenger. This gives just two-thirds of the weight per unit of paying load.

This difference in relation between dead and paying load exerts an important influence on the weight of a fast train. Trains are run with reference to their paying load, and if a train cannot earn enough to leave a margin above running expenses, the train must be discontinued or additional stoppages must be made so as to increase the number of passengers carried. The weight necessary to carry a profitable number of passengers is often so great that the attainment of a high average speed becomes impossible. While weight does not probably materially impair high speed on a fairly level road, or on a down grade, it is an all important factor in running up grade and in starting and getting under headway.

The importance of ascending a grade at a good speed may be illustrated by a catch question. A train ascends a grade 10 miles long at 30 miles and after reaching the summit runs down a similar grade at 60 miles per hour. What is the average speed? Most persons will state that the average speed is 45 miles per hour, the mean of 30 and 60, but this solution is erroneous, as any one can easily discover. In order to make a mean speed of 45 miles per hour the ascent should be made at 36 miles per hour, and the descent at 60 miles per hour. If the engine is unable to make the ascent at over 30 miles per hour the descent must be made at not less than 90 miles per hour in order to enable a mean speed of 45 miles to be obtained. In other words, an increased speed of 6 miles per hour in ascending the grade is equivalent to an increase of 30 miles per hour in descending the grade. The moral and the effect of heavy trains on high average speeds are equally obvious.

The present underground railroad in Glasgow has apparently proved so successful that a rival line, the Glasgow Central, has been sanctioned by Parliament. It is in all about seven miles in length, including some short branches. The main line is chiefly composed of a tunnel nearly five miles long, with only one break. The line starts from Maryhill, a northwestern suburb, and runs in a southeasterly direction underneath the Botanic Gardens, the Grea

Western road, Stobcross road, Argyle street, the Trongate, Bridgeton Cross and ends at the eastern end of the city by a junction with the Rutherglen and Dalmarnock section of the Caledonian system just north of the Clyde.

The line will have 11 passenger and five freight stations. The inside width of the tunnel will be 26 ft., and the rails will be from 18 to 23 ft. below the level of the busiest streets, the surface of which is only to be disturbed during the night. The line will probably be laid by taking up short sections of the pavement during the night, laying a temporary roof for the tunnel, and then replacing the pavement or laying a temporary pavement of planking above the temporary roof, under which the permanent tunnel will be built.

The steepest grade is about 60 ft. per mile. The line passes through rock, boulder clay and brick clay, though some portions will be through sandy clay containing much water. The side walls and invert of the tunnel are concrete, the roof being of brickwork, but under streets where head room is very limited, cast iron girders carrying brick jack arches will be used.

The cost of the land is estimated at over $1,000,000 and the works at $4,500,000. Allowing an additional 10 per cent. for contingencies, the total cost per mile will be $880,000, which is considerably below the cost of the London underground railroads. Reckoning 150 trains each way per day, earning $1 per mile, and allowing 50 per cent. for working expenses, the line should pay 6 per cent. profit on the gross outlay.

Glasgow having about 700,000 inhabitants, and being, therefore, considerably smaller than New York, it would appear that an underground railroad in New York would have a heavier traffic, despite the competition of the existing elevated railroads. Whether the cost of construction would be similar in New York and Glasgow is more problematical, but the success of underground railroads in Glasgow should encourage the promoters of similar lines here.

The report of Mr. J. S. Jeans, Secretary of the British Iron Trade Association, showing the production of pig iron and stock on hands, and the production of Bessemer and open-hearth steels, is at hand. The make of pig iron for three consecutive half years was as follows, in gross tons:

Six months to June, 30, 1888.	Six months to Dec. 31, 1887.	Six months to June 30, 1888.
3,902,804	3,773,812	3,668,115

	Tons.
Increase over previous six months	128,992
Increase over same period in 1887	234,689

Of the make during the first half of this year, 1,549,265 tons was hematite pig; 1,958,319 tons was forge and foundry pig; 153,053 tons was spiegel and ferro-manganese, and 242,185 tons was basic pig.

The stock on hand was 2,673,860 tons, against 2,616,366 tons at the end of 1887, or an increase in stored pig iron of 57,494 tons; showing an increased consumption and exportation of 71,498 tons. The increase of consumption in the United Kingdom for 1887 was 585,739 tons.

The production of Bessemer steel ingots for three consecutive half years was as follows, in gross tons:

Six months to June 30, 1888.	Six months to Dec. 31, 1887.	Six months to June 30, 1887.
1,051,481	1,148,849	915,554

	Tons.
Decrease from previous six months	97,368
Increase over same period in 1887	135,927

The production of Bessemer steel rails was:

Six months from June 30, 1888.	Six months to Dec. 30, 1887.	Six months to June 30, 1887
487,174	576,062	445,785

	Tons.
Decrease from previous six months	88,888
Increase over same period in 1887	41,389

Over 53 per cent. of the Bessemer steel ingots were disposed of as follows:

	Tons.
Plates, fish plates and angles	32,609
Bars, tees and forgings	104,759
Blooms and billets	170,711
Sleepers	46,961
Castings	2,234

The production of open hearth steel was:

Six months to June 30, 1888.	Six months to Dec. 31, 1887.	Six months to June 30, 1887.
616,421	575,714	405,390

	Tons.
Increase over previous six months	40,707
Increase over same period in 1887	211,031

The steel produced was used as follows:

	Tons.
Plates and angles	247,212
Bars, tees and forgings	77,171
Blooms and billets	12,551
Castings	8,634
Rails	7,950

The decided advance in the stocks of pig iron on hand is noticeable. Taking Mr. Jean's figures for the consumption of pig iron in 1887, 7,317,067 tons, the stock now on hand amounts to over 36½ per cent. of the annual British consumption, or, in other words, to a supply sufficient for 19 weeks, and must represent a locked-up capital of some $27,000,000. This stock, which first commenced to attract attention in 1882, when it amounted to 18.2 per cent. of the year's consumption, reached 37 per cent. in 1886, and fell to 36 per cent. last year.

The production of both Bessemer ingots and rails shows the effect of the loss of market in this country through the reduced railroad mileage under construction.

The increase in production of open-hearth steel, depending as it does so largely on ship-building, must be thoroughly satisfactory to the English iron masters, as it, to possibly a greater extent than any other British product, gives three profits, viz., the profit of production, the profit of ship building and the profit of ship owning.

At a directors' meeting of the Baltimore & Ohio, held on the 17th, it was decided to pass another semi-annual dividend. The last dividend on the main stem was a year and a half ago, though the stock of the Washington branch receives its regular semi-annual 5 per cent., which has not been interrupted. The business of the road has been heavy, freight traffic the past year increasing about 7 per cent., though rates on through traffic have been very low much of the time, as every one knows. The gross earnings have, nevertheless, increased about $1,000,000, and the decrease in net is explained by the President to be owing to extraordinary expenditures. The increase in expenses for roadway and bridges during the fiscal year is $325,000, and for repairs of engines and freight cars $154,000. Car trust and other debt to the extent of $386,000 has been retired, and $300,000 has been paid in dividends on preferred stock. The surplus is $105,000.

It is announced from London that a Pacific mail contract has been signed between the British Government and the Canadian Pacific. A monthly service of steamers is to be run from Vancouver to Yokohama, Shanghai and Hong Kong. The railroad company is to receive a yearly subsidy of £60,000 for the service, £45,000 from the Imperial Government and £15,000 from the Dominion. The matter does not end here, however, for it is said that "official commercial circles" in Canada think that if Canada is to become the British route to the East she must make sacrifices to initiate an adequate trans-Atlantic service. It is said that unless successful competition can be established with the Suez route by fast Atlantic steamers, the route by the Canadian Pacific and the Pacific will be useless.

A bill has been introduced into the House of Representatives to grant a charter to Rufus Hatch, Hugh R. Garden, Egbert L. Viele, Henry C. Davis, Moses B. Meclay, Charles D. Ingersoll and George C. Lee, their associates and successors, to build and operate a bridge between some point in New York city and the New Jersey shore. Of course the bill provides for a clear span across the Hudson with ample head room. Meantime the story is repeated at frequent intervals that English interests have taken up the Hudson tunnel and that it will be carried out under the engineering charge of Sir John Fowler and Mr. Benjamin Baker.

There is said to be a prospect that the Chignecto marine railroad will be built. At least, a dispatch from Ottawa announces that Mr. T. C. Keefer, President Am. Soc. C. E., has received news from London that a contract for its construction has been made. This ship railroad is projected from the head of the Bay of Fundy to Baie Verte in the Gulf of St. Lawrence. Mr. Keefer is one of the provisional directors named in the act of Parliament incorporating the company.

The October number of the *National Car and Locomotive Builder* contains the first of an interesting series of articles on railway car construction, by William Voss, of Cedar Rapids, Ia. Mr. Voss is Assistant Master Mechanic of the Burlington, Cedar Rapids & Northern Railway, being in charge of the car shops at Cedar Rapids. He writes in a clear and concise style, and we understand the articles will be reprinted in book form.

NEW PUBLICATIONS.

Centennial History of Allegheny County. By the Rev. A. A. Lambing, LL.D. and the Hon. J. W. F. White.

This volume is really a history of Pittsburgh and its immediate vicinity, and gives a brief notice of the principal manufacturing firms of the Iron City. It is stated that the estimated population of Pittsburgh proper is 237,000, while Allegheny counts for 96,000, boroughs in the vicinity 75,000, and townships of the county 122,000, making a total population of 530,000. The number of blast furnaces is 35 in Pittsburgh and 5 in the vicinity. The iron mills number 36 and the steel 20. The output of rails in 1887 was about 360,000 tons, structural iron 165,000 tons, pipe 320,000 tons, and railway supplies 132,000 tons. The capacity of the steel wire nail mills will, it is said, be shortly 108,000 tons per annum, while the crucible steel works have a capacity of 150,000 tons per annum, though the estimated output in 1885 was only 42,139 tons.

The plate glass industry has grown remarkably, and the capacity is now 250,000 sq. ft. per month, while 12,000,000 glass chimneys are made annually. The lead works turn out 22,000 tons of lead annually, and nearly 4,000,000 ounces of silver, while 900,000 kegs of white lead (25 lbs. each) are made. About 60,000,000 firebricks were made in 1887. Among the new industries the output of carbon points is estimated at 600,000 per month.

The Connellsville coke ovens now number nearly 12,000, consuming 7,500,000 tons of coal, and yielding between 4,000,000 and 5,000,000 tons of coke, worth about $6,000,000. One Pittsburgh tug, the "O'Neill," recently hauled a tow measuring 710 ft. × by 238 ft., covering an area of 5 acres and containing nearly 27,000 tons of coal, from Louisville to New Orleans. The trip, including return to Louisville, occupied 29 days. It is estimated that it would take 89 locomotives and 2,225 cars to haul this load of coal by rail. The total banking capital of Allegheny County is stated at nearly $12,000,000.

It is stated that the A. French spring works are the largest exclusively engaged in making springs in the world, covering 2 acres, employing 150 men, and having a capacity of 15,000 tons of finished springs per annum. The works were started in 1864.

The centennial of the county was celebrated Sept. 24, 25 and 26, amid circumstances, which with the present prosperity of Pittsburgh, form a strong contrast to the following account written by Arthur Lee in 1784: "Pittsburgh is inhabited almost entirely by Scots and Irish, who live in paltry log houses, and are as dirty as in the north of Ireland, or even Scotland. There is a great deal of small trade carried on, the goods being brought at the vast expenses of 45 shillings per cwt. from Philadelphia and Baltimore. They take in the shops money, wheat flour and skins. There are in the town four attorneys, two doctors, and not a priest of any persuasion, nor church, nor chapel; so that they are likely to be damned, without the benefit of clergy. The rivers encroach fast on the town, and to such a degree, that, as a gentleman told me, the Allegheny had in thirty years of his memory carried away one hundred yards. The place, I believe, will never be very considerable."

Law of Eminent Domain and of Railroads and Warehouses, comprising the constitutional and statutory provisions in the state of Illinois, together with the decisions relating thereto. Compiled and annotated by W. H. Manier. Springfield, Ill.: D. W. Lusk, 1888.

Nothing can give a more vivid impression of the amount of railroad law and legislation in the last few years than a digest of this kind. Although condensed with the utmost care, the body of the work occupied 379 closely printed pages and the index nearly a hundred pages more. While intended to apply specially to Illinois, the citations are not confined to cases which have arisen in that state. The compiler has kept in mind the wider bearings of his work; notably in the parts relating to the law of eminent domain, which will be hardly less useful in other states than in Illinois. The publisher has done his part of the work extremely well. The chief cause which interferes with the value of a digest like this is one for which neither the compiler nor the publisher are in any wise responsible. It is the shifting and uncertain character of transportation law which makes it unsafe to rely on any compilation, however good, if it is more than six months old. A story is told of a man who was nominated for a supreme court justiceship in one of our states, but who felt forced to decline the proffered honor, saying that he had been out of active practice for five years, during which time the Legislature had changed all the statutes, and the courts had upset all the common law principles. In matters of railroad law this is not so much of an exaggeration.

Reports on the Water Power of the United States. Tenth Census of the United States. Vol. XVII.

This is the second part of the Reports on Water Power which are collected under the general topic of "Statistics of Power and Machinery Employed in Manufactures" under the direction of Prof. W. P. Trowbridge, Chief Special Agent. Part I., which was issued some time since, comprised special reports by Prof. George F. Swain and Messrs. Dwight Porter and James L. Greenleaf on the water power of Eastern and Middle states and of the southern Atlantic and Eastern Gulf water-sheds. Part II. which now appears contains reports on the water power of the Northwest, of the Mississippi and some of its tributaries and of the Ohio River Basin and the Ohio state canals. These are by Messrs. James L. Greenleaf and Dwight Porter. There is also a report of 283 pp. on the water-supply of certain cities and towns of the United States, by Mr. Walter G. Elliot, special agent. The waterworks of the country are, in this report, grouped according to their systems of supply, as by gravity, direct pumping, etc., and a type of each system is described and much data of value is collected. The whole volume contains 788 pages, and the various reports are so well indexed as to make them convenient for consultation.

The Railroad, Telegraph and Steamship Builders' Directory. The Railway Directory Publishing Co., 18 Courtlandt street, New York.

This is a trade list giving names and addresses of the makers of all sorts of supplies "pertaining to the building and operating of railroad, telegraph and steamship companies." Lists of contractors are also given, and addresses of railroad officers having charge of purchasing and rolling stock departments. We have made no careful examination of the book to ascertain its completeness or accuracy; but it must necessarily be somewhat inaccurate, especially as it is a first edition. The lists are conveniently arranged, with an alphabetical index of material and supplies, and they cannot fail to be of considerable use.

Report of the New York Produce Exchange from July 1, 1887, to July 1, 1888.

The greater part of this volume consists of the by-laws and trade rules of the Exchange and other information of particular interest to members and dealers, but the report of the statistician gives a great number of tables of more general interest. These tables contain statistics of movement of domestic produce at New York and the principal ports and interior points, imports and exports, crops, prices, freight rates, etc.

The General Manager makes a first appearance in the ranks of comic journalism, and endeavors to lighten the somewhat prosaic labors of railroad officers with illustrations, plain and colored, of the amusing incidents of travel. The principal cartoon is an elaborate chromo of a limited express train. The locomotive and cars differ considerably in construction and arrangement from those in general use, but the devices used display great inventive talent, and appear to give unbounded satisfaction to the passengers. The jokes are more in the usual style, and appeal rather to the passenger than the railroad man. The poetry, however, especially the lines narrating the sad story of Maria and the conflagration, if original, is in a higher vein and shows an unexpected development of literary talent amid the uncongenial surroundings of cut rates, defunct pools and victim-

ized scalpers. *The General Manager's* headquarters are in Chicago, and the various railroad interests confided to his charge of one dollar per annum will be visited monthly.

TRADE CATALOGUES.

Tools: Palmer, Cunningham & Co., Limited, Market street, Philadelphia. This, the first catalogue issued by the firm, is a very complete illustrated and descriptive price-list of mechanics' tools, and includes nearly all small tools and implements required by machinists, vise hands, carpenters, pattern makers, blacksmiths, molders, etc.

The objects described comprise a variety of bolts, screws, nuts and washers, with drills, reamers, taps, dies and screw plates, many of the latter being of recent and improved forms. A great variety of chucks, vises, wrenches, hammers and chisels for different purposes are also illustrated. Track tools are also shown in considerable variety.

Some small machine tools, drills, planers and lathes, are also described, and various buffs and grinding apparatus are also shown.

Belting, belt stretchers, portable forges and blowers, tire-benders, punches, oil cans, lathe dogs, lathe tools, chasers, knurls, pliers, speed indicators, oilstones, pulley blocks, tube cleaners, files, saws and calipers are among the various articles treated, and this by no means exhaustive list will give a fair idea of the very comprehensive nature of the book, which will be found very useful to those needing machinist's supplies. The book is supplied with a good index, and is well illustrated and printed.

The Keystone Seal and Press Co., Limited, of 170 Broadway, New York City, has issued a little book describing its combined car seal and lock, with cuts of the seals and press, showing clearly the construction and operation of the latter. There are also several cuts showing the method of applying the seal to various styles of car doors. The cuts are of great beauty, and the whole work is printed on fine paper in very neat style. This seal, which was described in the *Railroad Gazette*, April 13 last, is well known to many of our readers. The chief claim for it is in its strength and the excellence of workmanship in its manufacture, and the construction of the sealing press in such a way that "the operator or sealer must do a good and perfect job or none at all; he must either do the sealing right or let it alone. It is a complete and reliable check on imperfect or careless sealing."

Drawing Instruments. Theodore Alteneder, Philadelphia. 1888.

This October catalogue contains no new designs, but is simply a more complete and correct representation of the drawing instruments made by Mr. Alteneder. He is best known by the joint which bears his name, patented nearly 40 years ago, and now in general use by other makers. An improvement on this joint, patented by Mr. Alteneder in 1871, has been used in his instruments only. These catalogues can be had free by addressing the manufacturer.

TECHNICAL.

Railroads in China.

Mr. John A. Church, who is in charge of certain Chinese mines and mining operations, writes as follows to the *Engineering and Mining Journal* of Chinese railroad matters: "This year will see the completion of about 100 miles of standard gauge railroad in the Empire, and there is little doubt that this line will eventually extend into a great system of iron roads. Fortunately, it is in the hands of most competent men, both native and foreign. Tong King Sing, the Chinese director, is well-known as one of the most advanced of Chinamen, who has been connected already with successful transportation projects in China. Mr. C. W. Kinder, the engineer-in-chief, is an Englishman whose services have won the confidence of the highest officials in the Empire. None but those who have experience of the Chinese can appreciate how important this reputation for ability, mingled with uprightness, is. The Chinese have all the money needed and the disposition to use it, but they lack confidence in themselves, in foreigners and in the outcome of industrial works in their country. It is rather the fashion to be carried away by the unbounded possibilities of commerce with, or construction for, three hundred million people, but the truth is, progress in China, in the foreign sense of progress, will be slow. Mr. Kinder's 100 miles of railroad is more promising than all the schemes of syndicates that have been proposed, and they are not few.

Pneumatic Train Signals in France.

The Paris, Lyons & Mediterranean Railroad of France is experimenting with a pneumatic train signal. A whistle is placed in the engineer's cab and one on the top of each passenger coach, and by means of a cord in each compartment these whistles are made to sound. The passengers inside the coach have no means of causing the whistle to cease sounding, and the alarm is continued until the whistle is readjusted from the outside.

Brakes in India.

One of the chief questions which will come before the Railway Conference at Simla is the use of brakes on Indian railways. At present the railways in the country are not provided with any special system of brakes, such as is in operation on almost every European line. Our railway depend entirely on hand-power brakes applied on the engines and brake-vans, but by way of practical experiment three systems of more efficient brake-power are shortly to be tried at Umballa.—*Indian Engineering.*

A Large Flume.

A flume 35¾ miles long was commenced near San Diego, Cal., in June, 1887, and is now nearly completed. The box is built entirely of 2 in. clear selected redwood without knots or sap. About 200 men have been constantly engaged and 9,000,000 ft. of lumber B. M. have been used. There are 315 trestles, the longest of which, Los Cochos, is 1,700 ft. long and 85 ft. high. Its construction required 250,000 B. M. ft. of lumber. The Sweetwater trestle is 1,200 ft. long and 85 ft. high. The main timbers used in these trestles are 10 × 10 and 8 × 8. They were put together on the ground and raised to their position by horse power. There are eight tunnels, the longest of which is 2,100 ft. long. The tunnels are 6 × 6 ft., with arched roof. The flume has a uniform grade of 4.7 ft. per mile. Much of the lumber had to be drawn 700 and 800 ft. up the sides of steep and rocky mountains. The lumber was loaded on cars running on a portable track and attached to a heavy wire cable. The motive power was furnished by a portable cable engine.

The Threshing Machine Boiler.

The threshing machine boiler is getting in very active work just at this time, a large percentage of the explosions which are reported being from that source. These machines are placed in charge of farmers and others who know nothing of their requirements, perform a little active service in the Fall, and serve out the rest of the year as hen-roosts, underneath the barn or out in the weather, with no provisions against their deterioration during that time. Put to work again without a proper overhauling it is little to be wondered at that they become a prominent feature of the fall lists of boilers explosions.—*Power.*

Train Pipe Coverings.

In their latest catalogue of sectional air coverings and asbestos materials, the Shields & Brown Co., of Chicago, include a jacketing for train pipes, of which they say: "Our coverings of this style are made up with a special reference to the needs and demands of railroad companies who are introducing systems of steam heating on their trains. In these goods we supply all the requisites of a compact, strong and durable covering that will stand the jarring of the train, and at the same time provide a first class non-conductor. These coverings are composed of a heavy wrap of asbestos sheeting next the pipe, then three-quarters of an inch of wool felt, then a wrap of asbestos on the outside, and a canvas jacket over all. The different layers of felt and asbestos are held together by being stitched with wire, so that they cannot pull apart. They are very easily applied. They are made in sections 3 ft. long, and we make a complete line of fittings of the same style for them." Several of the largest railroad and heating companies are using these coverings.

Launch of the Baltimore.

The United States cruiser Baltimore was launched at Cramp's ship-yard, on the Delaware, Oct. 6. The Baltimore is the largest vessel yet constructed for the "new navy," though the Newark and some others will be larger. The Baltimore has twin screws, and will be the first vessel so equipped in the navy. She is 335 ft. long over all, her beam amidships is 48.5 ft., her mean draught is 19.5 ft., and her displacement is 4,400 tons. The indicated horse-power of her engines is 7,500 at natural draught, and 10,750 at forced draught, and she is expected to make 19 knots an hour. She will carry two masts, fitted with military tops, and her crew will consist of 300 men. The Baltimore has a protective deck of thick steel plates, and under this, down below the water-line, are placed the rudder and the steam steering gear. The main battery consists of four 8-in. breech-loading rifled guns on the poop and forecastle, and six 6-in. rifled guns in sponsons, 18 ft. above the water. There will also be a second battery of six rapid-firing six-pounders, six Hotchkiss revolving cannon, and four Gatling guns. She will also carry five torpedo launching tubes or guns.

The Baltimore will be fitted up as a flagship and lighted with two electric plants. Ventilation will be secured by two large blowers, with a capacity of 10,000 cubic feet per minute. Two triple-expansion engines in separate water-tight compartments will furnish the motive power, and they will be supplied with steam from four double-ended, horizontal return tubular boilers, 14 ft. 8 in. diameter. The cylinders will be 42, 60 and 94 in. diameter, with a 42-in. stroke, and there will be three-bladed screws, about 14.5 ft. diameter. With 10,000 horse-power the Baltimore can make 456 knots a day, using 235 tons of coal. Her bunker capacity of 850 tons of coal will enable her to go three and a half days at full speed, covering in that time 1,637 knots. She can make 3,068 miles, or about the distance across the Atlantic, in seven and a half days, a speed nearly equal to that of the great passenger steamers.

The Brooklyn Bridge Railroad.

It is said that the switch and the continuous rail frog made by the Parsons Block, Switch & Frog Co., of New York, are to be put in use at once on the Brooklyn Bridge railroad. The switch can be worked from a passing engine.

THE SCRAP HEAP.

An Aid to the Car Hog.

American enterprise has a field in England where compartment cars are used, that is almost wholly wanting in this democratic country where the bulk of the passengers must often travel in one car, the only one on the train besides the smoker. *Invention*, of London, says: An enterprising American firm is said to be offering a remarkable novelty to railway travelers, viz: "squealing dolls," intended to keep the nervous and baby-haters out of a carriage. "After many years of constant labor," says the circular of this astute firm, "we have succeeded in constructing dolls that will squeal like babies. We can guarantee that no other traveler will enter a carriage with one of our A1 dolls when wound up, and we recommend those who wish to travel in comfort and alone immediately to procure one of them. The price of one of our A1 babies, with a loud persistent squeal, increasing in force, broken with fits of rage, is $10; that of No. 2, with a steady irritating sobbing, $5; whilst No. 3, which from time to time emits terrible screams, and can easily be stowed in the coat pocket, is $2.50."

New Station in Philadelphia.

A large force of workmen are employed in the erection of the new freight and passenger depot for the New Jersey lines of the Philadelphia & Reading Railroad, on Delaware avenue, between Chestnut and Walnut streets, in Philadelphia. The buildings occupy upwards of 200 ft. of the river front, and present an attractive architectural appearance. It is expected to have the work entirely completed in the course of a month. The trains from the various divisions of the Reading system in New Jersey connect with ferries which all land at this station.

Three Hundred Miles an Hour.

That is the proposed speed for the electric postal railroad of the future. An experimental line has been erected at Laurel, 20 miles from Baltimore. A compromise between the pneumatic tube and the ordinary railroad carries a miniature train of two cars, solely for mails and light parcels, without any attendance. The road has three rails, one above the car for carrying the current, and two below which carry the cars. The cars are built of sheet iron and are 2 ft. square and 21 ft. long. Speed will be regulated and power or brakes applied by electricity solely. If the experiment at Laurel succeeds, it is stated that similar roads will be laid between Baltimore and Washington and elsewhere.

Crude Oil for Fuel in St. Louis.

The St. Louis Shovel Co. have just introduced oil furnaces and are rapidly substituting them for coal furnaces, so that in ten days, or less, no other fuel will be used at their extensive works. The test is the first ever made in St. Louis, and has met with the support of the Standard Oil Co., who propose to build a pipe line from St. Louis to Huntington, Ind., and there connect with their main Western line, provided enough St. Louis manufacturers can be induced to use the oil. The oil is supplied to the St. Louis Shovel Co. in tank cars, two of which will be kept side-tracked near the company's works, from which the oil will be pumped into the storage tanks, and then into the supply tank. It costs delivered in St. Louis 1⅜ cents per gallon, and it is asserted that 120 gallons produces as much heat as a ton of anthracite coal, besides a saving of 20 or 25 per cent. in the cost of handling. In other words, the cost of oil is only one-third of the cost of hard coal.—*Iron Trade Review.*

Lake Superior Ores.

The lake shipments up to and including Oct. 3 aggregated 3,510,864 tons, against 3,795,883 tons up to the same time last year. The shipments by ranges were: Marquette, 1,376,157 tons; Gogebic, 1,003,386 tons; Menominee, 833,088 tons; Vermillion, 298,223 tons. Local and all rail shipments bring the total up to over 3,600,000 tons, insuring, according to the *Iron Trade Review*, the shipment of 4,060,000 tons this year. This has been accomplished without the aid of a boom, but through a healthy demand, and the mine owners are encouraged by the prospect of a continually increasing demand, through several months to come, to make arrangements for mining larger quantities through the winter.

She Occupied the Chair.

One day last week the Manistee & Northeastern Railroad Co. commenced laying track past the Sorenson boarding-house, in Manistee, Mich. As soon as Mrs. Sorenson discovered the workmen laying the track she, with revolver in hand, went to the workmen and demanded that they desist. They refused, whereupon she ordered a rocking chair to be brought out, and, planting it across two ties, she occupied the chair throughout the day, all night and until 5 o'clock the next evening, preventing the men from laying the rails, at which hour she was arrested and placed in jail, charged with obstructing the building of the railroad.

South Australian Railroads.

The report of the Treasurer of the Colony for the year ending June 30, 1888, shows that there were then 1,499¾ miles of road opened and 273¼ miles in the course of construction, costing, including the discount on the sale of bonds £11,488,917. The working expenses for the year were £434,000, and the revenue was £866,000, giving an income of 4.45 per cent. on the cost of the average mileage opened for traffic during the year.

Improved Back Action Railroad Accident.

On the cars—"So you are from Arizona?" "Yes." "How is the *Tombstone Hooter* coming on?" "Busted." "What busted it?" "A prominent citizen shot the editor." "What for?" "You see he wrote 'Horrible Blunder' as a head line to go over an account of a railroad accident, but the foreman made a mistake and put it over the account of a wedding."—*Texas Siftings.*

Germans Building Railroads in Australia.

The *Colonies and India* reports that a German syndicate has undertaken to build a railroad from Guildford to Geraldton, in Western Australia. The concession, which carries 12,000 acres of land per mile of road built, was first awarded to a British company, but they abandoned it, and it has now been taken up by a German syndicate, who propose to import their own labor and settle it on the land acquired when the road is completed. The proposed plan will not only give Western Australia a desirable class of immigrants, but will immediately afford them new railroad traffic from the farmers along its route. Aside from the investment of German capital in Australia, the incident is of interest, as it is believed to be the first Australian instance of the adoption of our land grant policy, which has done so much to develop both our population and our railroad mileage.

Demons of the Car.

Farewell address of the little star-shaped, red hot cinder: Old car, farewell! The hour has come when I must bid a long adieu: but still I'll cherish all the months of summer days I've flown with you: I've led discomfort through the train; I've put out many a laughing eye; the happiest hours I've drowned in pain. Good-by, old car, good-by. Inaugural of the car stove: How do, old car? The merry time of brittle rails and wrecking trains brings back the dear, familiar scenes when I'll get in my work again; full many a time in days gone by, I've roasted folks alive with you: you've been rebuilt—and so have I—how do, old car, how do?—*Brooklyn Eagle.*

A Heavy Train.

A freight train consisting of 87 loaded cars and a caboose, was recently pulled over the Birmingham Mineral road by one engine from Bessemer, Ala., to Thomas, a distance of 26 miles. The length of the train was 2,962 ft., and the estimated weight 5,222,000 lbs.

Freight Depot Burned.

The freight depot of the St. Louis, Vandalia & Terre Haute at East St. Louis was destroyed by fire early Oct. 13. The fire spread to adjacent buildings, including a hotel filled with people. Fifteen freight cars and 300 bales of cotton were destroyed, and the hotel was badly damaged, but no lives were lost. The loss is $60,000. Insured. This is the second destruction of the Vandalia's freight-house within a few years.

Notes.

A Chicago dispatch of Oct. 14 states that the Kane County grand jury has found indictments against John A. Bauereisen, Thomas Broderick, Alexander Smith, John A. Bowles, August Kaegel and George Godding, the men who were arrested at the time of the discovery of dynamite on the Burlington tracks, near Aurora.

The Order of Railway Conductors has addressed a circular to general managers, stating that it has perfected arrangements for keeping a full and correct record of its unemployed members, and requesting that the officers of the order may be notified of vacancies, so that they may have an opportunity of recommending their members, for either brakemen, conductors or yardmasters.

Superintendent A. B. Starr, of the Pittsburgh, Fort Wayne & Chicago, has been arrested, charged with being criminally liable for the death of a woman killed at a highway crossing in Pittsburgh, Pa., a year ago. The suit is brought under a provision of law making a manager responsible where proper precautions to prevent accidents have not been taken. Mr. Starr's bail was fixed at $5,000, and the engineer of the locomotive was also arrested and held in the same amount.

At Lincoln, Neb., one of the striking engineers of the Burlington road went into the grocery business, in which he patronized the freight department of the Burlington road. For this he was expelled from the Brotherhood, and it is stated has now gone back on the road and has a regular run.

The New York & New England offers a reward of $250

for the detection of the author of an anonymous circular recently sent to numerous Western shippers advising them not to ship over that road as consignees would not receive freight from it. It is surmised that the circular is issued by parties interested in overthrowing the company's system of demurrage collections. This road has also offered $1,000 reward for information leading to the recovery of 12 bales and 17 sacks of wool, missing from the Boston freight house. A further reward of $500 is offered for the conviction of any person implicated in the theft of the wool.

Thomas O'Brien, a clerk in the employ of the Old Colony at Boston, was last week arrested for stealing tickets and selling them to a policeman, who disposed of them to New York scalpers.

Albany dispatches of Oct. 12 reported a strike of yardmen on the New York Central at West Albany, but on the following day it was reported that the company had acceded to the demands of the men.

The Northern Pacific yardmen to the number of 25, at Brainard, Minn., struck for an increase of 25 cents a day. They were getting $2.25 per day, and the strike seems to have failed.

The grand jury at Rawlins, Wyo., has found twenty-one indictments against conductors and brakemen of the Union Pacific, accused of robbing freight trains of merchandise in transit between San Francisco and eastern cities. The robberies are supposed to cover between twelve and fifteen months and thousands of dollars' worth of valuables are missing.

RAILROAD LAW—NOTES OF DECISIONS.

Powers, Liabilities and Regulation of Railroads.

In New Jersey the Court of Error and Appeal decided that, as the charter of the Philadelphia & Reading was by its terms subject to alteration by the Legislature, it was not under the statute of April 2, 1873, as to the taxation of railroads, and therefore the acceptance by the company of the terms of that act did not create an irrepealable contract with the state, and the company is consequently subject to the provisions of the act of April 10, 1884 (P. L., 1884, p. 142), in relation to the taxation of railroad and canal property.[1]

In Tennessee the Supreme Court holds that under subscriptions to railroad stock on the following terms: "One-fourth to be paid when the road is completed to a certain county line," the remainder "to be paid in four equal installments, of four months, as the work progresses through the county, provided the company established a depot" at a certain point—the erection of the depot is not a condition precedent to payment of the subscriptions; and an assignee of the subscription list may maintain an action thereon for a call maturing after the road is completed to the county line, and while work thereon is in progress, though, at the time the action is brought, work on the road has been abandoned, the depot has not been built, the railway company is insolvent, and its property and franchises have been sold. But such action cannot be maintained for an installment not maturing until after all work on the road has been abandoned. An action may be maintained on a subscription to railroad stock, without a previous tender of stock certificates, though the contract of subscription provides that "certificates of stock issue to said subscribers, as to other subscribers in said company, upon payment of their subscriptions."[2]

In Texas the Supreme Court rules that where a tract of land is the property of a railroad company, without any limitation of ownership, and a horse railway company, for a valuable consideration, obtains the right to build its road over the land to the depot of the railroad, to the exclusion of other horse railroads, and the contract is recorded, the horse railway company is entitled to an injunction against another company interfering with this right.[3]

In New York, the Court of Appeals holds that no presumption against the power of a foreign corporation to subscribe for stock of a proposed railroad company in this state will be indulged, in the face of an actual subscription followed by the preliminary payment required by statute—for the purpose of questioning the validity of the incorporation of such railroad company, on a proceeding by it to acquire land.[4]

In Illinois the Supreme Court rules that an act entitled "An act to incorporate the St. Louis & Southeastern Railroad Co.," under the Constitution of 1848, declaring that "no private or local law which may be passed by the General Assembly shall embrace more than one subject, and that shall be expressed in the title," cannot authorize the making of a subscription, and issuing of bonds in payment thereof, by a county to the railroad; and such bonds issued for stock in the railroad corporation are void, no matter into whose hands they may come, and the taxes levied to pay interest on the same are without authority of law.[5]

Carriage of Goods and Injuries to Property.

In Pennsylvania it is held by the Supreme Court that the measure of damages for taking land for a right of way is the difference in the values of the land before and after the construction of the road. The question whether it was constructed so as to cause as little damage as possible should not be considered. The owner is not entitled to any more because his land is taken without his consent.[6]

In the same state the Supreme Court rules that where a mortgagee in possession at the time of the location of a railroad through the mortgaged premises takes from the railroad company a bond for damages and afterwards buys the land and has the damages assigned to him by the former owner, the railroad company cannot in proceeding to assess the damages avail itself as a defense of the fact that the plaintiff was not the owner at the time the road was located.[7]

In New York the Court of Appeals decides that where the state had mapped out, by public streets, blocks and lots, certain of its lands, and thereafter conveyed certain of such lots in one of the blocks "as known and designated" on said map, the grantee did not acquire such an easement in the street on which his lots fronted, beyond the block in which his lots were situated, as entitled him to compensation for, or to enjoin, the obstruction of such street on another block, by a railroad company under permission from the state and municipality—it appearing that the cross streets at each end of his blocks afforded passage to and from his premises, and that passage through the street on which his lots fronted, beyond his block and where the obstruction existed, was merely a convenience and not a necessity.[8]

In Indiana, after the plaintiff had conveyed the right of way to the defendant railroad, the railroad made an embankment about twelve feet high, but, the land being marshy, the embankment began to sink, and the railway company deposited upon the top of the embankment a large amount of earth, sand, and other material; and that such material, as it sank, spread, and extended under the surface of the land beyond the line of the railway right, and upheaved the plaintiff's land adjoining the right of way, and rendered worthless several acres of land. The Supreme Court holds the company liable for the damage.[9]

In another case in the same state the Supreme Court rules that where land is taken for a right of way, all damages for such taking must be recovered in one action; and in such action all injuries that may naturally and proximately result from the construction and operation of the railway may be recovered, and such damages accrue to, and must be recovered by the person who owned the land at the time the road was constructed. In order to entitle a grantee to maintain an action for such damages, he must first procure an assignment of the claim.[10]

In Kentucky the Court of Appeals holds that under the state constitution, providing that "no man's property shall be taken or applied to public use without just compensation being previously made to him," a railroad company cannot obtain a writ of possession while an appeal from the verdict of the jury, awarding damages for land sought to be condemned, is still pending, by giving its bond, but such damages must first be paid in money before the owner can be deprived of his land. The Court also holds that the statute of 1881, providing that, in the condemnation of land by a railroad company, the value of the land and material taken must be awarded separately from any damages that may result to the adjacent lands of the owner, does not require that the value of land taken from a small tract upon which the dwelling, barns, orchard, etc., of the owner stand, be awarded separately from the damages to the adjacent land in the same tract, resulting from the injury to the dwelling, barns, etc.[11]

Injuries to Passengers, Employes and Strangers.

An interesting ruling as to the right of a carrier to discriminate in its charges for passenger carriage is made by the Supreme Court of Louisiana. A charter granted by the city to a railroad running within the city of New Orleans contained this provision as to rates of fare: The rates of fare from Canal street to the head of Jackson street and the Napoleon avenue station, and points between, shall be (5) five cents, and (5) five cents beyond Napoleon avenue station, between the hours of 4 A. M. and 12:30 P. M., except to actual residents above Napoleon avenue, who shall have the privilege of purchasing through tickets at the rate of ten for 50 cents. A passenger who did not reside above Napoleon avenue obtained from a resident there a bunch of tickets, one of which was refused by the conductor, and on refusing to pay the regular fare was ejected. The Supreme Court hold the discrimination legal, saying: "It was unquestionably within the discretionary power of the city council in regulating the defendant's road to consider that, as the commercial centre of the city, the great majority of churches, schools, banks, courts and other institutions were clustered in the neighborhood of the centre of the city, and almost all below Napoleon avenue, it was simply an act of justice to actual residents above Napoleon avenue, in the pursuit of their daily avocations, and for other equally necessary purposes, to enable them to reach the central portion of the city with the same facilities, and at the same cost, which were afforded to all other residents of the city."[12]

In the same state it is held that operating a railroad is a "business" within a tax law, and that a grant of a right to lay rails in a street is not infringed by a subsequent exaction of a license fee for running cars thereon.[13]

In Alabama the Supreme Court holds that where city authorities threaten to arrest and fine any person engaged in the construction of an addition to a depot, the erection of which is claimed to be a violation of the city ordinance against erecting wooden buildings within certain designated limits, and also threaten to destroy the building if erected, equity will assume jurisdiction to protect the corporate franchise of the railroad company building such depot from invasion by such enforcement of an ordinance asserted to be void, or to have no application. The Supreme Court decreed that the ordinance did not apply to an addition to a brick depot, which addition rests on a solid brick foundation, and is intended to be incased with corrugated iron, and covered with sheet-iron roofing.[14]

In New York, the Court of Appeals rules that the giving of the statutory signals at a crossing does not render a railroad company free from negligence if it runs its train at an undue, and what might be found to be an improper and highly dangerous rate of speed through a village or city more or less densely populated.[15]

In Indiana the Supreme Court holds that an engineer on a passenger train is not bound to anticipate that the driver of a team which is seen slowly approaching the track, pulling a loaded wagon up grade toward the railroad crossing, is asleep; nor is he bound to stop his train, or even to check its speed, though he might see the driver reclining on the load. He has a right, having signaled his coming, and his train being in plain sight from the highway, to assume that the team will be halted before it reaches the track.[16]

The Alabama statute requires the engineer or other person in charge of a locomotive to ring the bell, or whistle, at least one-fourth of a mile before entering any village, town or city, and to continue to do so at intervals while running within the limits of the same. In an action by a father for the killing of his infant child, about two years old, within the corporate limits of a town, it appeared that the train was moving up grade at the rate of 12 or 15 miles per hour; that the road was straight for about 60 yards from where the child was killed, and then curved to the left; that the engineer had the cab-window on his right closed, but kept a lookout through the front window, but did not ring the bell or blow the whistle on entering the town, nor while passing. The Supreme Court holds the company responsible.[17]

In New York a person approaching, in the evening, a railroad crossing of several tracks on a city street—where there was no flagman, and where a part of the tracks ran to the shops and yards and were used for storing cars, two only of the tracks being those of the regular road for the passage of trains—stopped at the first track and looked both ways, and saw a train coming; this train stopped on the crossing to switch cars, and the person stepped upon another track to wait for it to get out of the way, and did not thereafter look either way for other trains, but kept watching the engine engaged in switching; in about a minute after stepping on such other track, a train came upon him without ringing the bell or sounding the whistle, and he received injuries for which he brought suit against the railroad company; it appeared that he had been in the habit of crossing the tracks frequently for some years, but he testified that he did not know which were the main tracks. The Court of Appeals holds that he was not negligent, and the company is liable.[18]

In New York one driving toward a railroad crossing looked twice up and down the track before attempting to cross, once at a distance of 100 and once at 60 ft. from the tracks, and looked a third time in one direction, and was about looking a third time in the other (his horses being but 4 ft. from the track) when his attention was taken up for a moment by seeing a person in front of him on the track, and immediately he heard a train, but could not then stop his horses, although going very slowly, and the horses were struck by the train and killed. The Court of Appeals decides that the driver's failure, under these circumstances, to look a third time in the direction from which the train came was not negligence.[19]

The statutes of Arkansas provide that "when any person shall be wounded by a railroad train running in this state, he may sue for damages in his own name; or, if he be a minor, his father, if living, may sue; and, if the father be dead, then the mother may sue; and, if both father and mother be dead, then the guardian of such minor may sue." A minor sued, by next friend, for injuries caused by a railroad train, and the company moved to dismiss the action because not brought by the proper party. The minor having come of age since the suit was brought, the motion was denied, and he was, on his own motion, permitted to prosecute the suit in his own name. The Supreme Court holds this proper, since under the above statute, two rights of action accrue; one to the minor for the personal injury, and one to the father, mother or guardian for losses suffered by him or her.[20]

1 State Board v. P. & R. R. R. Co., 13 Cent. Rep., 250.
2 P. & M. R. Co. v. Parks, 8 S. W. Rep., 843.
3 Fort Worth R. Co. v. Queen City R. Co., 9 S. W. Rep., 94.
4 Rochester, H. & L. R. Co. v. Babcock, 13 Cent. Rep., 234.
5 People v. Hamill, 15 West. Rep., 162.
6 Harlinan v. R. & P. R. Co. 12 Cent. Rep., 447.
7 State Line R. Co. v. Playford, 13 Cent. Rep., 94
8 Heer v. N. Y., W. S. & B. R. Co., 13 Cent. Rep., 237.
9 Roushlange v. C. & A. R. Co., 14 West. Rep., 853
10 Sherlock v. L., N. A. & C. R Co., 14 West. Rep., 843.
11 Asher v. L. & W. R. Co., 8 S. W. Rep., 854.
12 Forman v. N. O. & C. R. Co., 4 South. Rep., 246.
13 New Orleans v. N. O., C. & L. R. Co., 4 South. Rep., 512.
14 City Council v. L. & N. R. Co., 4 South. Rep., 626.
15 Thompson v. N. Y. Cent. & H. R. R. R. Co., 13 Cent. Rep., 240.
16 Ind., B. & W. R. Co. v. Wheeler, 15 West. Rep., 133.
17 Ga. Pac. R. Co. v. Blanton, 4 South. Rep., 621.
18 Blaiser v. N. Y., L. E. & W. R. Co., 13 Cent. Rep., 231.
19 Thompson v. N. Y. Cent. & H. R. Co., 13 Cent. Rep., 240.
20 Sibley v. Ratliffe, 8 S. W. Rep., 686.

General Railroad News.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Concord, 5 per cent., payable Nov. 1.
Wheeling & Lake Erie, quarterly, 1 per cent. on the preferred stock, payable Nov. 15.

Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Brooklyn & Montauk, annual meeting, 120 Broadway, New York City, Nov. 7.
Carolina, Cumberland Gap & Chicago, annual meeting, Aiken, S. C., Nov. 6.
Central Massachusetts, annual meeting, Boston & Lowell passenger station, Boston, Oct. 31.
Cincinnati, Indianapolis, St. Louis & Chicago, annual meeting, Indianapolis, Ind., Oct. 30.
Downington & Lancaster, 233 South Fourth street, Philadelphia, Pa., special meeting Nov. 5.
Hudson Connecting, special meeting, Room 11, Mills Building, 35 Wall street, New York, Oct. 30.
Indianapolis, Decatur & Western, annual meeting, South Meridian street, Indianapolis, Ind., Nov. 6.
Illinois & St. Louis Railroad & Coal Co., annual meeting, Belleville, Ill., Oct. 18.
Poughkeepsie Bridge, special meeting, Room 11, Mills Building, 35 Wall street, New York, Oct. 30, to vote on a proposition to mortgage the road for $200,000.
Poughkeepsie & Connecticut, special meeting, Room 11, Mills Building, New York, Oct. 30, to vote on a proposition to create a mortgage for $1,000,000.
Raleigh & Augusta Air Line, annual meeting, Raleigh, N. C., Nov. 8.

Railroad and Technical Conventions.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *American Association of Railway Chemists* will hold its next meeting in Baltimore, Md., in October.

The *New England Railroad Club* meets at its rooms in the Boston & Albany passenger station, Boston, on the second Wednesday of each month.

The *New York Railroad Club* meets at its rooms, 113 Liberty street, New York City, at 7:30 p. m., on the second Thursday in each month.

The *Central Railway Club* meets at the Tifft House, Buffalo, the fourth Wednesday of January, March, May August and October.

The *American Society of Civil Engineers* holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third street, New York.

The *Boston Society of Civil Engineers* holds its regular meetings at its rooms in the Boston & Albany station, Boston, at 7:30 p. m. on the third Wednesday in each month.

The *Western Society of Engineers* holds its regular meetings at its hall, No. 67 Washington street, Chicago, at 7:30 p. m., on the first Tuesday in each month.

The *Engineers' Club of Philadelphia* holds regular meetings at the house of the Club, 1,122 Gerard street, Philadelphia.

The *Engineers' Society of Western Pennsylvania* holds regular meetings on the third Tuesday in each month, at Pittsburgh, Pa.

The *Engineers' Club of Kansas City* meets at Kansas City, Mo., on the first Monday in each month.

The *Civil Engineers' Society of St. Paul* meets at St. Paul, Minn., on the first Monday in each month.

The *Montana Society of Civil Engineers* meets at Helena, Mont., on the third Saturday in each month.

Civil Engineers' Society of St. Paul.

The October meeting of the society was held the 1st inst. Mr. J. D. White, City Engineer of Fargo, was elected a member. The form of contract for buildings, as recommended by the National Association of Builders, was brought up for discussion but laid over to the next meeting. Mr. Loweth, President of the society, read a paper on tests of angle bars, the results of which bore especially upon the influence of rivets and rivet holes in such members. This was illustrated by drawings. Mr. A. Münster followed with a paper on the highways and railroads of Norway, giving a sketch of the general topographical features of Norway, and describing the wagon roads and railroad systems. Some striking examples of railroad location were exhibited by photographs and drawings.

Engineers' Club of Philadelphia.

A regular meeting was held Oct. 6, 1888, President Joseph M. Wilson in the chair: 25 members and 2 visitors present.

Mr. Frederick Stamm presented a paper on "Chimneys for Horizontal Tubular Boilers." The author discusses the subject of chimney draft under various conditions, and presents formula for area of flue and height of stack, with examples.

Mr. H. W. Spangler presented a paper on "Leaky Pistons and Indicator Cards."

It is generally assumed that the curves of expansion and compression on an indicator card taken from an engine

having tight piston and valves and unjacketed cylinder, should be a rectangular hyperbola, having clearance and vacuum lines as asymptotes. If piston and valves leak, the curves should be no longer of this nature, and it is practically impossible that these leaks should neutralize each other at the extreme end of the expansion curve and beginning of compression. If a scant line is drawn cutting an hyperbola, the parts of this line between the curve and the asymptotes should be equal. If, therefore, the curve is an hyperbola, a line drawn cutting the expansion line would cut the vacuum and clearance at equal distances from the curve. As the clearance cannot always be obtained, points can be determined in this way that should fall on the clearance line. If two points are determined from the expansion line, or one from the expansion and one from the compression, these points should be in a line at right angles to the vacuum line. An attempt to apply this to cards from engines known to be tight, and taken by indicators in good order, in many cases has shown that the curves are not hyperbolas. In attempting to work out the equation of the curves, the difficulty of obtaining the clearance, even approximately, has reduced the number of cards available for the work much below that from which one would desire to make any general deductions. The results here given are taken from various makes of engines, making from 60 to 200 revolutions, developing from 30 to 250 indicated horse-power, and these are given that they may interest others in the matter, and either tend to prove or disprove the generally accepted idea. Assuming that the equation of the curve is in the form $p\ v^n$ = constant, the values of n have been generally between 1.15 and 1.35, or $\frac{2}{3}$ and $\frac{1}{4}$. It is to be noted that Grashof gives 1.15 for the value for compression curves and 1.33 for expansion curves when the steam is dry after expansion.

Mr. Frank Cooper read a paper upon the "Economics of Momentum Grades, with Especial Reference to Tributary and Suburban Railways."

The object of this paper is to outline a method by which an approximate idea may be formed of the relative effects produced by a succession of sags 26.4 ft. deep, in comparison with a dead-level line of railroad, taking various speeds of trains, with stops located from 1 to 10 miles apart. Having determined under fair conditions the energy thus saved, and knowing the average percentage of cost of fuel per train-mile to operating expenses, and to net earnings according to the census of 1880, then applying the percentage of energy saved to this cost of fuel, an estimate may be formed of the value of the principle. There are three grades in the vicinity of Philadelphia where this action may be studied: between Germantown Junction and North Penn Junction, N. Y. Div. P. R. R.; on the Bound Brook R. R., just beyond Jenkintown, from Noble to Somerton, and on the Germantown and Ch. Hill Br. P. R. R. From the moment of starting at Westmoreland until that of stopping at Queen Lane on this last grade, a distance of 1.5 mile, not infrequently an average speed is obtained of 35 to 37 miles per hour, with three and four passenger cars on the ordinary accommodation trains. On the Bound Brook sag, six miles were recently made in 5 min. 32 sec., from summit to summit; a mile, at the foot, in 50 sec.

The secretary presented, for Mr. Robt. A. Cummings, a Table of Square Feet in Decimals of an Acre, for the Reference Book.

The Brotherhood of Engineers.

The twenty-fifth annual convention of the Brotherhood of Locomotive Engineers was begun in Richmond, Va., Oct. 17. The public exercises consisted of an address of welcome by Mayor Ellison, speeches from Governor Lee, Colonel A. S. Buford and Judge S. R. Witt and the reading of the annual address by Chief Arthur.

PERSONAL.

—Benjamin Norton, Second Vice-President of the Long Island, sailed for Europe last week by the steamship "Germanic." He will be absent about five weeks.

—Oscar G. Murray, General Freight Traffic Manager of the Missouri Pacific, has resigned to accept a like position with the Cincinnati, Indianapolis, St. Louis & Chicago, and the Chesapeake & Ohio, with headquarters at Cincinnati.

—Jacob Sprague, Jr., who recently died at South Braintree, Mass., aged 58 years, was for 20 years General Passenger Agent of the Old Colony, and was Auditor of Passenger Accounts at the time of his death. He began his railroad career in 1854.

Edward A. Greene, Chief Engineer of the Zanesville & Ohio River and the Shawnee & Muskingum River roads and the New York & Shawnee Coal Co., has resigned to engage in contract work. His address is 114 S. Fairfax street, Alexandria, Va.

—George B. Cornell, who resigned the position of Chief Engineer of the Brooklyn and Union Elevated road, to accept a similar position on the Chicago & South Side Rapid Transit, has been succeeded in the former position by O. F. Nichols, of the Suburban Rapid Transit road of New York.

—Professor Henry C. Adams, of Michigan University, and recently of Cornell University, has been appointed statistician to the Inter-state Commerce Commission. Professor Adams is the author of valuable papers on political science, and of a work on public debts which has been received with much favor.

—George Gregory died at his home near Bradford, Ill., recently, at the age of 81 years. He was the last but one of the officers engaged in building the Northern Cross Railroad from Meredosia to Springfield, Ill., which was undertaken in 1837, and is said to have been the first railroad enterprise inaugurated in Illinois.

—George A. Dadmun, Division Ticket Agent of the Philadelphia, Wilmington & Baltimore, died in Philadelphia Oct. 10. He was born at Templeton, Mass., and entered the railroad service as clerk with the Vermont & Massachusetts in 1848, where he remained until July, 1854, when he became connected with the ticket department of the Philadelphia, Wilmington & Baltimore. He was successively appointed Paymaster and General Ticket Agent, which latter position he held from Oct. 1, 1859, until the purchase of that road by the Pennsylvania in 1881, at which time he was appointed Division Ticket Agent of the Philadelphia, Wilmington & Baltimore.

—George Rumford Baldwin, A. M., fellow of the American Academy of Arts and Sciences, died at North Woburn, Mass., Oct. 12, at the age of 90. He was an eminent civil engineer, and a descendant of a family noted for the number of engineers it has produced. Mr. Baldwin was the engineer for Canada in bringing the water-works to Quebec from the Indian village of Lorette, and also designed and built the Boston Marine Railway; was consulting engineer for the Charlestown water-works, engineer of the water-works at Quebec, was connected with the early surveys for the Cape Cod Canal, and was consulted by the state in regard to the improvement of the South Boston flats.

ELECTIONS AND APPOINTMENTS.

Arkansas & Gulf.—The following are the directors of this new Arkansas company: John D. Adams, of Little Rock; J. M. Whitehall and James Murphy, of Arkansas City; J. Baxter, of Nashville, Tenn.; Thos. R. Sharp, of New York, and J. Baxter, President of the Kentucky & Arkansas Land and Industrial Co., of Arkansas City. The principal office is to be at Arkansas City.

Cartersville & Gainesville Air-Line.—The directors of this new Georgia road are W. H. Howard, M.A. Hardin, W. J. Heyward, George H. Waring, L. S. Mumford, W. C. Baker and John J. Calhoun. The general officers are at Cartersville, Ga.

Central Vermont.—The following directors were elected at the annual meeting in St. Albans, Vt., Oct. 10: J. G. Smith, E. C. Smith, of St. Albans; J. R. Langdon, of Montpelier; Joseph Hickson, of Montreal; B. P. Cheney, of Boston; W. H. H. Bingham, of Stowe, and Robert Wright, of Montreal.

Cherokee Central.—The directors of this new Kansas company are: J. T. Lyon and W. J. Wyly, of Talequah, I. T.; F. M. Shaw, D. C. Finn, H. R. Crowell and E. C. Scammon, of Cherokee County; O. J. Nichols, Frank Lanyon and J. D. Barker, of Pittsburgh; J. D. Hill and Joseph Chenault, of Fort Scott; George D. Cook, of Chicago.

Cincinnati, Sandusky & Cleveland.—The annual meeting of the stockholders was held in Cleveland this week, and the following new directors were elected: J. O. Moss, Charles H. Moss, Sandusky; A. S. Bushnell, Springfield. Subsequently the board elected J. S. Farlow, President; Isaac Fenno, Vice-President, both of Boston; J. L. Moore, Sandusky, Secretary and Treasurer.

Consolidated of Vermont.—The stockholders elected the following directors at their annual meeting: J. G Smith, E. C. Smith, of St. Albans; J. R. Langdon, of Montpelier; Joseph Hickson, of Montreal; B. P. Cheney, of Boston; W. H. H. Bingham, of Stowe, and John Bell, of Belleville, Ont.

Covington & Macon.—A. G. Craig has been appointed General Freight Agent. A. Craig Palmer continues General Passenger Agent.

Dodge City & Denver.—The directors of this new Kansas company: A. T. Soule, Wilson Soule, of Rochester, N. Y., and W. W. Mussell, M. W. Sutton, J. W. Gilbert, of Dodge City, who are also interested in the new Dodge City, Montezuma & Trinidad road.

East Line & Red River.—The following directors were elected at the annual meeting last week: John C. Brown, J. A. Baker, W. H. Abrams, R. C. Foster, F. H. Pendegrast, Albert Gould, John Bacon and E. W. Taylor. The election of officers was postponed.

Evansville & Terre Haute.—The following directors were elected at the meeting at Evansville, Ind., this week: William H. Payne, James T. Woodward, C. C. Baldwin, James M. DeVeau, James Stillman, Heman Clark, John W. Ellis, T. W. Evans, Benjamin Russak, S. T. Nelson, all of New York; D. J. Mackey, William Heilman, F. W. Cook, all of Evansville.

Henderson State Line.—The company has elected the following officers: S. K. Sneed, President; J. H. Barret, Jr., Vice-President; S. L. Marshall, Secretary and Treasurer. Directors: W. W. Shelby, John H. Barret, Jr., S. K. Sneed, A. S. Winstead, T. W. Priest and C. W. Johnson, of Henderson County; C. C. Watkins and J. F. Blanford, of Daviess County; Jep C. Johnson, of McLean County; C. N. McElroy, of Warren County, and Henry D. McHenry, of Ohio County.

Louisville & Nashville.—Robinson Wallace has been appointed Traveling Freight Agent, at Montgomery, Ala., vice R. E. Lutz, resigned.

Louisville, St. Louis & Texas.—J. K. McCracken has been appointed General Passenger Agent, with headquarters at Louisville. The President of the road is also to act as General Manager.

New York, New Haven & Hartford.—William A. Rockefeller has been elected a director to succeed to the vacancy caused by the death of A. B. Van Nest.

New York & Northern.—At the meeting of the stockholders in New York, this week, a new board of directors was elected, of which only H. F. Dimock, George J. Forrest, and G. M. Smith hold over from last year. The following are the names of the full board; John S. Barnes, Charles T. Barney, J. J. Belden, A. M. Billings, Thomas Denny, H. F. Dimock, George J. Forrest, Robert M. Gallaway, George G. Haven, R. S. Hayes, O. H. Payne, George W. Smith, William C. Whitney. The directors organized by electing R. S. Hayes, President; George J. Forrest, Vice-President, and W. H. Rockwell, Secretary and Treasurer.

Northern Michigan —The incorporators of this Michigan company are R. R. Goodell, James R. Cooper, John B. Duncan, Johnston Vivian, Thomas L. Chadbourne, with C. A. Wright for Vice-President and General Manager, and headquarters at Hancock.

Norwich & Worcester.—Edward P. Clapp, Assistant Treasurer, has been appointed Treasurer, vice George L. Perkins, deceased.

Ohio & Mississippi.—At a meeting of the directors in Cincinnati last week, all the officers were re-elected, and also the following directors: F. P. Dumpfel, of New York; F. W. Tracey, of Springfield, Ill., and Geo. S. Morrison, of Chicago.

Owensboro, Falls of Rough & Green River.—The following officers were elected at the annual meeting: H. C. Hear, President; J. A. Fuqua, Vice-President; George V. Triplett, Secretary; General Attorney, James H. Parish.

Owensboro & Nashville.—The following directors were elected at the annual meeting held in Louisville: Milton H. Smith, S. R. Knott, H. W. Barr, A. M. Quarrier, R. S. Bevier, Ed. Baxter and H. C. Murrell, of Louisville, Ky.

Pullman Palace Car Co.—The annual meeting was held in Chicago last week. Over $14,000,000 of capital stock was represented. The following were re-elected: George M. Pullman, John Crerar, Marshall Field, J. W. Doane, Norman Williams, O. S. A. Sprague, of Chicago, and Henry C. Hulbert, of New York.

Pullman Southern Palace Car Co.—The stockholders of the company held their annual meeting in Louisville, Oct. 13. The directors elected were: George Pullman, L. H. Hayes, T. G. Weeks, James Yarton and George F. Brown.

Rochester & Honeoye Falls—H. D. McNaughton, of Rochester, is President of this company, and A. Grant Childs, of Kingston, N. Y., is Chief Engineer.

South Beach (Staten Island).—The directors of this new company are Frank H. Steele, William C. Crain, Daniel G. Thompson, Edward S. Kaufman, Charles D. Newton, Robert H. Thomas and Adolph L. King.

South Carolina.—C. O. Little has been appointed Supervisor of Trains, to succeed Thomas Hughes, promoted to the position of Master of Transportation in charge of train and car service.

Southern Pacific.—W. T. Fitz Gerald has been appointed District Passenger Agent of the South Pacific Coast Railway Division.

Union Pacific, Lincoln & Colorado.—The following are the Board of Directors and officers of the consolidated company: C. F. Adams, of Boston, President; F. L. Ames, of Boston, Vice-President; F. G. Dexter, E. Atkins, M. D. Spaulding, of Boston, J. S. Cameron, of Omaha, A. L. Williams, of Topeka. James G. Harris is Treasurer, and Alexander Millar is Secretary.

OLD AND NEW ROADS.

New Companies Organized.—Arkansas & Gulf.—Cherokee Central.—Dodge City & Denver.—Northern Michigun.—South Beach.

Alabama Midland.—A construction company with a capital stock of $3,000,000 has been formed to construct the road, which is projected to extend from Bainbridge to a point near Montgomery.

Arkansas & Gulf.—The company has filed a charter in Arkansas to build a road from a point in Chicot County, Ark., near the state line between Arkansas and Louisiana, through the counties of Chicot and Desha to Arkansas city, thence northwest through the counties of Desha, Lincoln, Arkansas, Lonoke, Prairie, White, Cleburne, Stone, Independence, Izard, Sharp and Fulton to a point on the Kansas City, Fort Scott & Memphis, in Fulton County. The proposed line is to be 275 miles in length and the capital stock is fixed at $2,750,000.

Atchison, Topeka & Santa Fe.—A dispatch from Topeka dated Oct. 16 states that orders have been given by General Superintendent S. L. Sands to superintendents and heads of the mechanical departments to reduce the working hours 16 per cent. at once. The reduction is made by cutting off one hour each day and a half day Saturday. It has been the custom every winter to cut down the number of working hours, but it is done earlier than usual this year.

Mr. George C. Magoun, of Kidder, Peabody & Co., of Boston, who has been elected a director, says that the floating debt of $4,000,000 will be retired by an issue of $7,000,000 of notes bearing 6 per cent. interest and running three years. They are to be secured by a new second mortgage on the main line of the road, which mortgage is to be cancelled upon payment of the notes.

Baltimore & Ohio.—At the monthly meeting of the Board of Directors this week the approximate earnings for September were stated to be $1,801,574, a decrease of $253,111, as compared with the corresponding period last year. The expenses were $1,141,805, a decrease of $11,087 for the corresponding period in 1887. On the recommendation of the Finance Committee a dividend on the common stock on the business of the road for the six months ended Sept. 30, 1888, will not be paid, but a dividend of five per cent. was declared on the stock of the Washington branch for the half year ended Sept. 30, 1888.

Canadian Pacific.—A cable dispatch from London says that a Pacific Mail contract has been signed between the Imperial government and the company, and tenders for three steamers will be received within a week. The stipulated service is to commence in 18 months, the company receiving annually £45,000, from the Imperial Government in addition to £15,000 from the Dominion Government for monthly service for ten years from Vancouver, not only to Yokohama and Hong Kong as first intended, but also calling at Shanghai.

The locating survey for the line from London to Windsor, Ont., opposite Detroit, has been finished, and grading will soon be commenced.

Carolina, Knoxville & Western.—It is stated that arrangements have been made in New York to float the first-mortgage bonds of the road, and the stock of the company will be doubled. Work which has been going on in Tennessee and North Carolina will be stopped and the entire force concentrated on the line between Greenville, S. C., and Knoxville, Tenn.

Cartersville & Gainesville.—This company has been organized to build a road from Cartersville to Gainesville, Ga. From Cartersville the line runs for the first 20 miles through the iron and manganese districts of North Georgia; thence through Beasley's Gap, Pine Log Mountains and the marble region, and traverses it for a distance of 20 miles, crossing the Marietta & North Georgia road at Ball Ground. Just beyond Ball Ground the line enters the valley of Long Swamp Creek, three miles above which are located very extensive marble quarries. After leaving this region the line enters an agricultural country to its connection with the Richmond & Danville at Gainesville. Bonds to the amount of $20,000 and stock to the amount of $10,000 per mile have been issued.

Cherokee Central.—Charter filed in Kansas to build a road from Fort Scott to the south line of the state, thence through the Indian Territory to Tahlequah, and thence southeasterly to Fort Smith, Ark., the estimated length of the line being 200 miles. The capital stock is $1,000,000.

Chicago, Kansas & Nebraska.—The tracklaying was completed to Colorado Springs, Oct. 12, bringing the road to the foot of Pike's Peak. The connection with the Denver & Rio Grande was made later, and freight trains will at once be put on between Denver and Norton, Kan. Passenger traffic will commence Nov. 11. The arrangements for the use of the Denver & Rio Grande tracks between Colorado Springs and Denver have been completed. Surveyors are engaged in running a line to Denver from a point at or near the place where the line turns to the south, about 70 miles from Denver.

Chicago, Milwaukee & St. Paul.—The Adams Express Co. has contracted with this road to do the express business on about one-half its mileage. The United States Express Co. has heretofore had the contract for express traffic on this part of the road.

Chicago, St. Paul & Kansas City.—Judge Spencer, of St. Joseph, has rendered a decision in the case of this company against the Kansas City, St. Joseph & Council Bluffs, allowing the former the use of the tracks of the latter company through the city of St. Joseph. This suit has been pending for over a year, and was brought to obtain an entrance into the St. Joseph Union depot. The Kansas City, St. Joseph & Council Bluffs road claimed that it possessed a special charter granting it exclusive rights to the streets of St. Joseph. The litigation has delayed the extension of the line to Kansas City via Leavenworth, but it is announced that grading will be commenced next Spring.

Cincinnati, Indianapolis, St. Louis & Chicago.—It is expected that by Nov. 10 the North Bend cut-off will

be so nearly completed that both freight and passenger trains can be run over it, abandoning altogether the tunnel that is now used.

Cleveland & Marietta.—The tunnel between Guernsey and Kimbolton, O., the construction of which was commenced 18 months ago, is now completed, and regular trains have commenced running through it.

Dodge City & Denver.—Charter filed in Kansas to construct a standard gauge road from Dodge City to Denver, passing through the counties of Ford, Finney and Gray in Kansas. The estimated length of the road is 375 miles, and the capital stock of the company is $2,000,000. The projectors of the road are interested in the Dodge City, Montezuma & Trinidad road, as well as in many other enterprises for developing Western Kansas.

Duluth, Red Wing & Southern.—It is reported that work is now in progress all along the line of the road between Red Wing and Zumbrota, Minn., and that the grading will be nearly finished in 30 days. The sub-contracts between Zumbrota and Albert Lea will be let this fall. The contract for laying the track between Red Wing and Zumbrota has been awarded to P. Brennan, of Owatonna.

Duluth & Winnipeg.—An act granting the company the right of way through the Fond du Lac Indian Reservation in Minnesota has been signed by the President.

East Tennessee, Virginia & Georgia.—The directors at a meeting in New York this week approvek a lease of the road for 99 years to the Richmond & Danville. The terms of the lease make the first preferred stock a guaranteed five per cent. security, and provide that certain proportions of the earnings above the five per cent. shall go to the junior securities of the road. For the first four years the proportion is to be 33⅓ per cent. of the gross earnings, then for five years 35 per cent., with 36 per cent. for five more years, with 37 per cent. during the remaining time. The Richmond & Danville directors have already agreed to the lease.

Eastern Minnesota.—The company has filed with the district court a petition for condemnation proceedings against seven blocks of property in the heart of the city of Duluth. The land is valued at $250,000, and will be used for terminal purposes in connection with the Duluth Terminal Co's road, which will be built by the Duluth, South Shore & Atlantic and the Eastern Minnesota, from the Northern Pacific bridge along Rice's point and thence to Sixth avenue west, where there will be a depot. This track will be used solely for freight, but above it will be an elevated track of wood, for the present, on which passenger trains will run, thus avoiding all grade crossings. This will allow the roads to make the run between West Superior and Duluth in seven minutes.

Eutawville.—The convicts who were at work grading this road have been removed, as the work for which they were engaged has been completed. It is rumored that the extension from Brockton to Sumter, S. C., has been abandoned.

Fort Smith, Paris & Dardanelle.—The first 5 miles of this road from Fort Smith toward Dardanelle, Ark., was completed last week. This secures the aid voted by the city of Fort Smith.

Gloucester & Atco.—Three surveys have been made for this projected New Jersey road, and the route will be definitely determined in a few days. The new line will be about 17 miles long, and will form a link in the Central of New Jersey system. It passes through Chew's Landing, Blackwood's Town, Clemington and Atco. The $400,000 bonds were taken up in a few days. The directors are many of them identified with the United States Express Co. and the Central of New Jersey.

Great Northern.—The grading is about completed on the first eight miles of the extension from New Glasgow, P. Q., to Ste. Julienne, and tracklaying and ballasting on this part of the road will be commenced this week. The contractor for the entire extension is John McEnroe, of Schnectady, N. Y., and he expects to have 10 miles of the road completed this fall. The road was built from Ste. Jerome to New Glasgow, a distance of 8 miles, some four years ago, and the survey was run as far as Montcalm at that time. Several changes in the original survey between New Glasgow and Ste. Julienne were made, and a party of engineers this week commenced to run a new line as far as Ste. Gabriel de Brandin, about 50 miles east of New Glasgow. The general direction of the line is northeast, nearly parallel with the St. Lawrence River. It is intended to reach Quebec, which will be the terminus.

Henderson State Line.—A party is to be put in the field within two weeks, to run the preliminary survey of the road which is projected to extend from Henderson, Ky., to Knoxville, Tenn., via Calhoun, Hartford, and Bowling Green. A survey of the route was made several years ago. It is expected to commence building the road early next year.

Louisville, St. Louis & Texas.—This road was formally opened for traffic between Owensboro and Stephensport, Ky., a distance of 90 miles, last week. That part of the line between Louisville and Stephensport will be opened next week.

Louisville Southern.—Work has been begun at Lawrenceburg, Ky., on the Lexington branch, extending from Lawrenceburg, Ky., to Lexington, Ky.,

Manitoba & Northern Pacific.—The Red River Valley line was opened this week from Winnipeg to Pembina, Dakota. It is expected that the line from Winnipeg to Portage La Prairie will be completed by Nov. 1.

On the prorogation of the Manitoba Legislature the Government announced the conclusion of the agreement with the company to build into the Souris District a new line, to be aided by a provincial guarantee of bonds to the extent of $5,000 a mile.

Mexican National.—This road, which passed into the control of English parties, greatly through the distrust in this country of Mexican enterprises, consequent on articles of like tenor to that of the Hon. John Bigelow in *Harper's Magazine*, is now completed between the Rio Grande and the City of Mexico. The English obtained posession in July, 1887, and work on the unfinished 480 miles was commenced in October. The last spike was driven on Sept. 29, and the road will be ready for traffic about Oct. 20. Mr. Robert Moore, C. E., of St. Louis, who was sent out to report on the construction work, criticises the methods employed severely, averring that an amateurish method, costly in many ways, has been pursued.

The advisability of changing the gauge of the road from narrow to standard seems already to be under discussion; its necessity, if the road is to become a trunk line, being apparent. It seems remarkable that the Government of Mexico should have subsidized systems of lines of two different gauges when each crossed the other at different points. The principal work remaining is to connect the line starting from the City of Mexico, now ending near Zamora, with the line commencing at Manzanillo in the state of Colima.

Midland.—A company has been organized under this name to build a road from Greenwich, N. Y., to Rutland, Vt. A branch to Whitehall, N. Y., to reach canal and lake transportation, is also contemplated. Hon. H. W. Hughes, of Greenville, is one of the prime movers of the enterprise.

Missouri, Kansas & Texas.—No plan of reorganization has as yet been agreed upon, but the following is outlined as the one likely to go through. The holders of 6s and 5s will be asked to accept a 4 per cent. bond, and the 7s will receive 1 per cent. more, or a 5 per cent. bond The stockholders will be assessed about $5 per share. Income bonds will be given to make up the difference between the old and the new rates of interest, and new stock, with a bond representing the assessment will be given to stockholders coming into the organization. This plan would call for an issue of $18,320,000 5 per cents. and $27,267,989 4 per cent. bonds. The difference in the interest on the bonds and the assessment on the stock would call for $3,108,569 of new incomes. The assessment on the stock would bring in cash $2,320,250. The interest charges on the new 4s and 5s would be $2,006,719 per annum. This, however, makes no provision for the $581,000 second mortgage incomes, and the $455,248 second mortgage income interest bearing scrip, which would probably receive a like amount of new incomes, which would make the necessary issue $4,144,817. The net earnings in 1887 were only $1,866,582, but operating expenses were an abnormally large percentage of gross earnings—74½ per cent. With gross earnings the same as in 1887 and operating expenses reduced to 68 per cent., the company would have net earnings of $2,357,000, or over $350,000 in excess of first charges on the new 4s and 5s. The annual report for 1887 shows a debit balance of $7,007,664, which would have to be provided for by an issue of some character.

Missouri Pacific.—The Kansas City *Times* states that arrangements have been nearly completed, by which the company will erect extensive shops for the entire system at Kansas City on land owned by the company and located on the west side of the Kaw River, between the Wyandotte Union Pacific bridges. At present the road leading from the west end of the Sixth street bridge to Riverview passes over this ground, and the company proposes to build a viaduct at its own expense which will elevate the road and allow the company full use of the ground.

Nashville & Knoxville.—Grading on the section between Gordonsville and Cookeville, Tenn., has now been completed, with the exception of 10 miles. Work on the Carthage branch is not making much progress at present, but when the bridge over Mulharin Creek is placed in position tracklaying will be commenced.

New Haven & Derby.—The completion of the extension from Derby to Botsford, Conn., 15 miles, was celebrated on Oct. 17 by the driving of a silver spike in the presence of prominent railroad officers and citizens.

Northeastern Rapid Transit.—The committee of the Philadelphia City Councils, to whom was referred the ordinance giving the company right to build through certain streets of the city, has reported unanimously in favor of the passage of the bill. The company proposes to construct an elevated railroad from Tacony to League Island, with a branch to Jenkintown. The ordinance secures damages to abutting property owners by the deposit of $1,000,000 security in addition to that required by the law of the state. It prohibits the carrying of freight, limits the rate of fare to five cents, morning and evening, and secures the payment of a percentage of the gross receipts of the company to the city.

Northern Michigan.—Articles of incorporation have been filed at Detroit to build a road from Houghton, in the copper-producing district of the Upper Peninsula, to Watersmeet, about 70 miles. The survey for the line is reported to be already in progress.

Northern Pacific.—Reports have been current lately that the company had made some arrangements for entering Chicago over the Wisconsin Central tracks. President Colby, of the Wisconsin Central, stated this week that arrangements will be made by which through trains will be run over the Wisconsin Central and Northern Pacific roads.

Pullman Palace Car Co.—The following statement of earnings and expenses for the year ending July 31, 1888, was read at the annual meeting in Chicago:

Revenue.

From earnings of cars	$6,259,371	
From patents	10,817	
From manufacturing, rentals, dividends, interest, etc	1,239,566	
		$7,509,754
Disbursements.		
Operating expenses	$2,506,584	
Proportion of net earnings paid other interests in sleeping car associations controlled and operated by this company	1,045,398	
Interest	132,450	
Dividends	1,510,890	
Repairs of cars in excess of mileage	198,871	
Contingency reserve	100,000	
		5,494,194
Surplus of revenue carried to credit of income account		$2,015,561

The total number of cars operated was 1,420. The assets of the company aggregate $34,641,664.

President Pullman supplemented his annual report with the following general information:

During the fiscal year the Baltimore & Ohio sleeping and parlor car plant has been purchased, including a contract for the operation of Pullman cars upon that system for 25 years. The joint interest of the New York, Lake Erie & Western in the sleeping and parlor car plant of its system has also been purchased, including a contract covering the entire Erie lines for 25 years. The Ohio & Mississippi, Cincinnati, Washington & Baltimore and the Chicago & Atlantic roads have made similar contracts for the same period. A contract for 15 years with the Texas Panhandle system has also been made; also the Wabash Western, Canada & Atlantic and Mexican National companies.

There has been built during the year 147 sleeping, parlor and dining cars, costing $16,382 each, or an aggregate of $2,408,217. There are now under construction 90 cars, the estimated cost being about $17,000 each. The total number of persons employed in the manufacturing and operating departments is 10,530; wages paid during the year, $5,516,201.

The number of cars employed in the service is 1,420; number of passengers carried 3,482,906; mileage of cars, 120,801,807. The total mileage covered by contracts for the operation of cars is 106,131.

Richmond, Nicholasville, Irvine & Beattyville.—Ground was broken on this new Kentucky road at Nicholasville, Oct. 11, and the grading was formally begun. It is an extension of the Louisville Southern, and has been voted subsidies amounting to $1,055;000, and has also private subscriptions given amounting to $79,000. The road is to be completed by Jan. 1, 1890.

St. Louis, Arkansas & Texas.—A large amount of second mortgage bonds were recently placed in New York, and President Fitzgerald, of the Mercantile Trust Co., of New York, states that by the arrangement the company will receive a little more than $2,000,000 in cash which will provide for the November interest, the floating debt and the needed new rails. The members of the Committee are Messrs. George Coppell, N. Gernsheim, Louis Fitzgerald, Russell Sage and George Gould.

It is stated that steps are being taken for the extension of the road from Hillsboro to San Angelo, Tex.

Salt Lake & Western.—A survey is being made for a line about five miles long to be built from Silver City or else from between Ironton and Silver City to Eureka, Utah Ter., and connect with the mines in that vicinity. The road is part of the Union Pacific system.

San Diego, Cuyamaca & Eastern.—The company has made arrangements for placing $500,000 bonds, secured by a mortgage on the first 20 miles of the road. The bonds are part of an authorized issue of $1,000,000. The estimated cost of the construction and equipment of the first 20 miles of the road, which will carry it from San Diego to the further limits of the El Cajon Valley, is $500,000, but this cost has been provided for almost entirely by stock subscriptions, so that the $500,000 bonds may be applied to the construction of the road beyond Lakeside. The road is projected to extend to The Needles, Cal.

Saratoga, Mount McGregor & Lake George.—This road, which extends from Saratoga Springs to Mount McGregor, N. Y., 11 miles, and which has been in a receiver's hands since last March, was purchased this week by W. J. Arkell, Vice-President.

Seattle, Lake Shore & Eastern.—The grading on the division from Spokane Falls west to Davenport, Wash. Ter., has been completed for a distance of 45 miles, and construction trains will be used in tracklaying as soon as the large bridge over the Columbia, west of Spokane Falls, is finished.

South Beach.—Organized in New York to build a connecting road, one mile long from the Arrochar station of the Staten Island Rapid Transit Company in the town of Edgewater to South Beach. The capital stock is $50,000.

Southern Pacific.—All the grading on the line from Fresno down the east side of the San Joaquin Valley to Poso has been completed, and the tracklaying has been finished up to within a few miles of Poso. The grading on the Tracy branch has been completed for a distance of 110 miles. The track has been laid from Tracy to Newman, while the grading is finished to Armonia, on the Huron branch line.

A force of graders have commenced work on the new coast line. At present there is a gap between Templeton, below San Luis Obispo County, and Elwood, 14 miles north of Santa Barbara. It is intended to put about 1,200 men at work as soon as possible.

South Pennsylvania.—The suit between the projected South Pennsylvania and the Pennsylvania will be begun before the Master appointed by the United States Court in New York before the end of this month. The Pennsylvania will begin the case by presenting testimony to show that the two roads when built will not be parallel lines, and hence the purchase of the South Pennsylvania is valid and constitutional.

Toledo & Chicago Air Line.—A company has been organized in Goshen, Ind., with M. Mercer as President, for the purpose of building a road from Toledo to Chicago. Mr. Mercer has been connected with the Canada & St. Louis, now being built by J. J. Burns, of Battle Creek, Mich., between that city and Danville, Ill., and Goshen, Ind.

Toledo, Columbus & Southern.—The road was bought at special master's sale at Findlay, O., Oct. 16, by the Toledo & Ohio Central. The sale was made by order of the United States Court for the benefit of the first mortgage bondholders. The property brought the sum of $600,000. The present terminus of the road is in Findlay, but it is understood that the line will be built into Columbus.

Toledo, Saginaw & Mackinaw.—This road has been leased to the Toledo, Ann Arbor and North Michigan, and will hereafter be operated as a division of that system. The road has but recently been completed, and extends from East Saginaw south to Durand, Mich., a distance of 53 miles. At Durand it connects with the Chicago & Grand Trunk as well as the Toledo, Ann Arbor & North Michigan.

Union Pacific.—Tracklaying on the extension to Colby, Thomas County, Kan., is in progress from Plainville west, and from Colby east. Sixty-seven miles of the track has already been completed, leaving 29 miles to complete the road between these points. The extension from Waldo to Plainville, 35 miles, is already finished.

Union Pacific, Lincoln & Colorado.—The articles of consolidation filed in Colorado, referred to last week, were for the Kansas corporation, representing $20,000,000 capital stock, and the Colorado corporation, representing $7,500,000 capital stock. No increase of stock is made by the consolidation. The Kansas Company owned a number of lines starting from Salina, the main line extending to the west line of the state, with various branches, some still in course of construction. The Colorado Company's line connects with the Kansas Company's at the latter's western terminus in Arapahoe or Elbert County, running west to Denver, with a branch to Manitou, also a branch from the east line of Bent County, thence southwest through Pueblo and Fremont County to Cañon City, with spurs running to the coal mines and stone quarries, thence south through Bent and Las Animas counties to the south line of the state.

Western New York & Pennsylvania.—A petition was filed last week in the United States Circuit Court at Pittsburg, Pa., by this company, asking to be allowed to appeal to the United States Supreme Court from the decision of Judge Acheson, in the case of Edward W. Kinsley against the Buffalo, New York & Philadelphia Railroad. Exceptions were filed by the attorneys of the plaintiff in the case, the chief ground being that the Western New York & Pennsylvania, although purchasers of the Buffalo, New York & Philadelphia Railroad and directly interested in the suit, are not parties to the record. Arguments on the exceptions will be heard Oct. 26.

Winona & Southwestern.—A construction company has been formed at Winona, Minn., with a capital stock of $200,000, to build this road, which is to extend from Winona to Omaha.

TRAFFIC AND EARNINGS.

Traffic Notes.

The Wabash Western has put on a line of through sleeping cars between St. Louis, Denver and Cheyenne, via Kansas City and the Union Pacific.

Omaha dispatches state that the Chicago & Northwestern

and Union Pacific have arranged for the running of through sleeping cars between Chicago and Denver.

The steamers controlled by the Old Colony, which have run between New York and Providence during the past summer, will after Oct. 21 run to and from Stonington instead of Providence.

Rates by the Sault Ste. Marie route between New York and St. Paul are announced as follows, beginning Oct. 20:

From New York, via the New York, Ontario & Western:

1	2	3	4	5	6
$1	91c.	71c.	47c.	40c.	33c.

From New York, via Canada Atlantic, the change will be as follows:

Present rates	60c.	50c.	40c.	30c.	24c.	20c.
New rates	95c.	88c.	68c.	44c.	38c.	31c.

A blockade of wheat is reported at Minneapolis. Over 1,000 cars are on the tracks and Eastern roads are unable to furnish cars to handle it promptly. The Union Pacific is 3,000 cars behind its orders. These items are only samples of similar ones from all parts of the country.

The Wisconsin Central has agreed to defer its proposed withdrawal from the Northwestern Passenger Association until Oct. 23, and the Minneapolis & St. Louis has promised to adhere to rates.

West-bound Rail-and-Lake freight rates are announced to be advanced, Oct. 26, from 35, 30, 24, 17, 15, 13 to 51, 45, 35, 24, 20, 17, New York to Chicago.

The various divisions of the Western Freight Association have made a specific division of certain duties of Chairmen Midgeley and Faithorn. It is agreed that Colorado, Utah and Pacific coast traffic via Kansas City and Southwestern Missouri River points shall be under the charge of Chairman Midgeley, while that going via Omaha and Council Bluffs is to be taken care of by Chairman Faithorn. It is understood that th $2,000 per annum drawn by Mr. Midgeley for administering the affairs of the Colorado, Utah and Pacific coast associations will be cut off, he simply receiving bis salary as Chairman of the Southwestern Division. The salary of Chairman Faithorn is to be slightly advanced on account of the additional duties imposed on him.

Chicago and Ohio River.

The roads between Chicago and the Ohio River are reported to have voted, at a meeting in Indianapolis last week, to sever their connection with the Central Traffic Association and to reorganize the old Chicago and Ohio River Association. A temporary organization was effected, to continue until Jan. 1, with W. H. McDoel, Traffic Manager of the Louisville, New Albany & Chicago, as chairman.

The Hollowness of the Punch Photograph.

Denver dispatches state that the Burlington has announced that it will restore passenger rates to Missouri River points on Oct. 21. The cause of the sudden reduction, as reported last week, is stated as follows by a representative of the Atchison, Topeka & Santa Fe: The cut was made by the Santa Fe because of the Burlington and Union Pacific failure to keep the contract as to tourist tickets from the Missouri River west. Since last May those roads have not been taking up tourist tickets sold by scalpers, which under the contract they were compelled to do. According to the agreement, only the original purchaser could return on the tourist ticket, but many had sold their tickets to scalpers, and were returning east over these lines contrary to the compact. These tickets were all punched to give a general description of the party; whether tall or low in stature heavy or light, male or female, bearded and if so how worn, dark or light complexion, etc. The words on the ticket that describe the tourist are so punched that when returning the conductor can easily tell whether the person was the original buyer of the ticket. All tickets on the Santa Fe in the hands of parties not meeting the description were taken up, which has caused the Santa Fe to incur the enmity of the scalpers. In order to find out whether the other roads were keeping the agreement the Santa Fe had agents buy return tourists tickets and sent passengers out over the Union Pacific and Burlington to see if they would be taken up, but they were not. A large, fat man was given the tourist ticket of a small man; one man was given the ticket of a woman, and thus several cases were worked up in which the parties holding the scalpers' tickets were as different as possible from the original purchasers.

The other roads deny the Santa Fe's story, and say that as far as possible they took up all tickets not in the hands of the original purchasers.

Earnings of South Carolina Roads.

The South Carolina Railroad Commission has issued its report of the earnings of the various roads in the state during August. Out of the 27 roads included in the report only 4 show a decrease in earnings compared with August of last year. The total passenger earnings were $187,172, an increase of $21,000. Total freight earnings were $305,000, an increase of $36,000. The roads of the Richmond & Danville system show increases in freight earnings, aggregating 11½ per cent.

East-bound Shipments.

The shipments of east-bound freight from Chicago by all lines for the week ending Saturday, Oct. 13, amounted to 62,039 tons, against 59,105 tons during the preceding week, an increase of 2,934 tons, and against 36,591 tons during the corresponding week of 1887, an increase of 25,448 tons. The proportions were:

Lines.	P. c.
Wabash	10.7
Michigan Central	11.0
Lake Shore & Mich. S.	14.6
Pitts., Ft. Wayne & C.	12.9
Chic., St. L. & Pitts.	11.9
Baltimore & Ohio	4.4
Chicago & Grand Trunk	14.3
N. Y., Chic. & St. L.	8.4
Chicago & Atlantic	11.8
Total	100.0

Of the above shipments, 2,485 tons were flour, 27,024 tons grain, 3,242 tons cured meats, 1,921 tons lard, 8,153 tons dressed meats, 868 tons butter, 1,911 tons hides, 452 tons wool, and 3,432 tons lumber. The three Vanderbilt lines carried 34 per cent. of the week's shipments, while the two Pennsylvania lines secured 24.8 per cent.

Cotton.

The cotton movement for the week ending Oct. 12 is reported as follows, in bales:

Interior Markets;	1888.	1887.	Decrease.	P. c.
Receipts	174,994	177,314	2,320	1.3
Shipments	133,537	145,733	12,196	8.4
Stock	139,667	179,580	39,913	22.2
Seaports:				
Receipts	250,644	276,876	26,232	9.7
Exports	105,633	142,441	26,808	25.8
Stock	407,928	526,325	118,397	22.5

Anthracite Coal Tonnage.

Mr. John H. Jones, Chief of Bureau of Anthracite Coal Statistics, has issued the following statement of anthracite coal tonnage for the month of September, 1888, and the year to Sept. 30, as compared with same period last year:

Month of September:

	1888.	1887.	Inc. or Dec.	
Phila. & Read.	830,951	736,302	I.	94,649
Lehigh Valley	668,473	471,821	I.	196,652
Central of N. J.	595,431	391,543	I.	203,887
Del., Lack. & W.	699,311	596,614	I.	102,697
Del. & Hud. Canal Co.	442,357	404,778	I.	37,579
Pennsylvania	415,492	331,039	I.	84,453
Pennsylvania Coal Co.	145,846	148,951	D.	3,104
N. Y., L. E. & W.	118,464	56,606	I.	61,858
Total	3,916,325	3,137,654	I.	778,671
From Wyoming Region	2,116,797	1,921,513	I.	195,284
" Lehigh "	628,248	244,362	I.	383,886
" Schuylkill "	1,171,280	971,779	I.	199,501

Nine months—Jan. 1 to Sept. 30:

	1888.	1887.	Inc. or Dec.	
Phila. & Read.	4,951,677	5,363,257	D.	414,580
Lehigh Valley	4,735,501	4,701,675	I.	33,825
Central of N. J.	4,120,521	3,652,048	I.	468,473
Del., Lack. & West.	5,025,815	4,078,526	I.	947,289
Del. & Hud. Canal Co.	3,289,336	2,793,595	I.	495,741
Pennsylvania	3,474,076	2,748,025	I.	726,051
Pennsylvania Coal Co.	1,243,138	1,096,809	I.	146,329
N. Y., L. E. & W.	695,551	564,514	I.	131,037
Total	27,535,616	25,001,450	I.	2,534,166
From Wyoming Region	16,141,451	13,178,722	I.	2,962,729
" Lehigh "	3,844,577	4,255,629	D.	411,051
" Schuylkill "	7,549,587	7,567,099	D.	17,512

The stock of coal on hand at tide-water shipping points Sept. 29, 1888, was 370,811 tons; on Aug. 31, 1888, 396,752 tons; decrease, 25,941 tons.

This statement includes the entire production of anthracite coal, excepting that consumed by employés, and for steam and heating purposes about the mines, but does not represent the entire anthracite coal tonnage actually transported by the respective roads, adjustment being necessary in the compilation to avoid duplications, etc.

Railroad Earnings.

Earnings of railroad lines for various periods are reported as follows:

Month of September:

	1888.	1887.	Inc. or Dec.		P.c.
Atlantic & Pacific	$226,969	$166,225	I.	$60,744	36.5
*Bur., Ced. Rap. & N	193,667	180,710	I.	12,957	6.1
Canadian Pacific	1,110,000	1,063,207	I.	46,793	4.4
Cape F. & Yad. Val.	27,554	28,637	D.	1,083	3.8
Central of Iowa	132,570	121,370	I.	11,200	9.2
Central Vermont	258,795	249,095	I.	9,700	3.9
*Chesapeake & Ohio.	277,953	295,431	D.	17,478	5.8
Ches., Ohio & S.	169,215	187,046	D.	17,831	9.5
Chicago & Atlantic	188,765	212,301	D.	23,536	11.2
Chi. & East Ill.	196,498	183,481	I.	13,077	7.1
Chi. & Ind. Coal	48,376	43,680	I.	4,696	10.7
Chi., Mil. & St. Paul.	2,478,000	2,359,624	I.	118,376	5.0
Chicago & Ohio R.	10,207	7,772	I.	2,435	31.2
Chi., St. P. & K. C.	250,258	215,241	I.	35,017	16.3
Chi. & W. Mich.	114,871	122,040	D.	7,169	5.9
Cin., Jack. & Mack.	53,578	53,746	D.	168	.3
Cin., N. O. & Tex. Pac.	321,154	309,917	I.	11,237	3.6
Ala. Gt. South.	118,866	137,863	D.	18,997	13.8
N. O. & North East	63,423	56,332	I.	7,091	12.5
Vick. & Mer.	28,833	51,939	D.	23,106	44.4
Vick., Sh. & Pac.	39,338	58,816	D.	19,478	33.1
Cin., Rich. & Ft. W.	36,899	39,272	D.	2,373	6.0
Cin., Wash. & Balt.	196,779	218,399	D.	21,620	9.9
*Cleve., Akron & Col.	59,969	37,273	I.	22,696	60.8
Cleve. & Marietta.	23,155	26,909	D.	3,754	13.9
Col. & Cin. Midland.	46,860	31,005	I.	15,855	51.1
Col., Hock. V. & Tol.	307,820	261,689	I.	46,131	17.6
Denver & Rio Grande	710,300	753,551	D.	43,251	5.7
Den. & Rio G. W.	125,100	120,000	I.	5,100	4.3
Det., Lansing & No.	96,244	102,042	D.	5,798	5.6
East Tenn., Va. & Ga	469,853	504,481	D.	34,628	6.9
Evansville & Ind.	24,891	22,019	I.	2,872	13.1
Evans. & T. Haute.	76,007	80,750	D.	4,743	5.9
Flint. & Pere. Mar.	180,974	223,833	D.	42,859	19.2
*Georgia Pacific.	66,591	84,955	D.	18,364	21.6
Gr. Rapids & Ind.	193,521	224,091	D.	30,570	13.6
Other lines.	15,595	16,463	D.	868	5.2
†Grand Trunk of Can.	1,727,907	1,797,882	D.	69,975	3.9
Houston & Tex Cen.	336,228	353,925	D.	17,697	5.0
Humeston & Shen.	14,800	16,908	D.	2,108	1.2
Ill. Cen. (Ill. & So. Div.)	910,671	1,099,738	D.	189,067	17.2
Cedar Falls & Minn	10,620	9,781	I.	839	8.6
Dubuque & S. C.	88,975	77,592	I.	11,383	14.7
Iowa Falls & S. C.	69,061	66,507	I.	2,554	3.9
Ind., Dec. & Western.	39,763	38,674	I.	1,089	2.8
Kanawha & Ohio.	24,674	19,914	I.	4,760	23.9
*Kan. C., Ft. S. Mem.	249,288	263,457	D.	14,169	5.4
*Kan. C., Clin. & Sp.	18,075	14,700	I.	3,375	22.9
Kentucky Central.	101,322	107,318	D.	5,996	5.6
*Keokuk & Western.	23,435	24,169	D.	734	3.0
Kingst. & Pembroke.	20,500	18,893	I.	1,607	8.5
Lehigh & Hudson.	22,785	17,694	I.	5,091	28.7
*Little Rock & Mem.	37,142	60,597	D.	23,455	38.5
Long Island.	371,341	359,996	I.	11,345	3.2
Louis., Evan. & St. L.	85,035	92,701	D.	7,666	8.3
Louis., N. Alb. & Chi.	217,619	214,346	I.	3,273	1.5
Louis., N. O. & Tex.	148,755	181,248	D.	32,493	17.9
Mar., Col. & N.	7,641	6,611	I.	1,030	15.6
Memphis & Charles.	104,391	156,499	D.	52,108	33.3
‡Mexican Central.	367,847	367,945	D.	98	....
*‡Mexican Railway.	125,200	215,264	D.	90,064	41.8
Mil., L. Sh. & West.	281,356	334,075	D.	52,719	15.8
Minn. & St. Louis.	120,500	129,720	D.	9,220	7.1
Mo., Kansas & Tex.	587,568	621,334	D.	33,766	5.4
Int. & Gt. Northern	328,159	333,393	D.	5,234	1.6
Mobile & Ohio.	174,157	242,948	D.	68,791	28.3
N. Y. C. & H. R.	3,350,038	3,438,555	D.	88,517	20.2
N. Y. & Northern.	52,671	53,727	D.	1,056	1.9
N. Y., Ont. & West.	163,598	156,742	I.	6,856	43.7
Norfolk & Western.	397,094	377,234	I.	19,860	5.2
Northern Pacific.	1,644,708	1,408,210	I.	236,498	16.7
Ohio & Mississippi.	390,995	408,054	D.	8,059	2.0
Ohio River.	54,044	43,538	I.	10,506	24.1
Ohio Southern.	48,009	52,881	D.	4,872	9.2
Ohio Valley of Ky.	10,324	8,158	I.	2,166	26.4
Peoria, Dec. & Evans	71,739	78,402	D.	6,663	8.5
Pittsburg & Western.	175,918	200,341	D.	24,423	12.2
Prescott & Ariz. Cen.	10,137	6,831	I.	3,306	48.6
Rich. & Danville.	404,050	439,427	D.	35,377	8.1
Va. Midland Div.	152,900	165,300	D.	12,400	7.5
Charl., C. & A. Div.	68,200	86,931	D.	18,731	21.6
Col. & Greenv. Div.	39,400	50,726	D.	11,326	22.3
Western N. C. Div.	48,600	68,555	D.	19,955	29.1
Wab., O. & W. Div	14,625	15.100	D.	475	3.1
Ashev. & Spar. Div	11,050	9,539	I.	1,511	15.9
St. L., A. & T. H. br.	86,133	94,975	D.	8,842	9.3
St. L., Ark. & Tex.	289,866	285,032	I.	4,854	1.7
St. L. & San Fran.	567,212	593,496	D.	26,284	4.4
St. Paul & Duluth.	163,181	185,512	D.	22,331	12.0
San A. & Aran. Pas	95,440	57,670	I.	37,770	65.4
Staten Island Rap. T.	97,363	92,387	I.	4,976	5.4
Texas & Pacific.	525,883	543,377	D.	17,494	3.2
Tol. & Ohio Central.	110,017	107,419	I.	2,598	2.4
Tol., Peoria & West.	93,099	94,440	D.	1,341	1.4
Valley of Ohio.	58,692	57,375	I.	1,317	2.3
Walash Western.	562,343	619,013	D.	56,670	9.2
West N. Y. & Penn.	309,100	278,420	I.	30,680	11.0
Wheeling & Lake E.	74,386	64,025	I.	10,361	16.2
Wisconsin Central.	384,032	368,683	I.	15,349	4.1
Total	$27,512,165	$28,042,957	D.	520,792	1.8

Month of August:

	1888.	1887.	Inc. or Dec.		P.c.
Bur., C. R. & No.	$215,206	$237,634	D.	$22,428	9.4
Net	35,031	47,400	D.	12,369	26.1
Cairo, Vin. & Chic.	75,758	78,322	D.	2,564	3.2
Net	31,508	37,146	D.	5,638	15.2
Central Iowa	115,344	112,869	I.	2,475	2.2
Net	8,311	17,339	D.	9,028	52.2
Chi., Bur. & No.	186,537	181,226	I.	5,311	2.9
Net	45,570	45,255	I.	315	.7
Georgia Pacific.	101,621	109,082	D.	7,461	6.8
Net	16,496	38,819	D.	22,323	57.5
Mexican National.	176,729	139,163	I.	37,566	26.3
Net	8,318	11,136	D.	2,818	25.4
Minn. & St. Louis.	106,181	105,900	I.	281	.2
Net	34,064	30,426	I.	3,638	12.0
Ohio River.	50,475	44,591	I.	5,884	13.2
Net	26,955	27,001	D.	46	....
Ore. Ry. & Nav. Co.	563,211	422,776	I.	140,435	33.2
Net	246,189	181,923	I.	64,257	35.3
Petersburg	31,621	27,598	I.	4,033	14.6
Net	def. 396	10,222	D.	10,618	....
Rich. & Petersburg.	20,459	19,131	I.	1,328	7.0
Net	def. 147	8,006	D.	8,153	....
Wisconsin Central.	377,929	357,573	I.	20,356	5.7
Net	133,384	.....	.....	.....	....
Total (gross)	$1,643,142	$1,478,282	I.	$164,860	11.2
Total (net)	451,890	454,673	D.	2,783	.6
Month of September:					
Marietta, Col. & No.	$7,641	$6,611	I.	$1,030	15.6
Net	3,594	3,449	I.	145	4.2
Nash., Chat. & St. L.	271,179	270,147	I.	1,032	.4
Net	108,550	121,404	D.	12,854	10.6

Eight Months—Jan. 1 to Aug. 31:

Bur., Ced. R. & No.	$1,662,736	$1,812,268	D.	$149,532	8.3
Net	307,770	379,275	D.	71,505	18.9
Cairo, Vin. & Chi.	467,132	492,047	D.	24,915	5.1
Net	136,499	154,394	D.	17,895	11.6
Central Iowa	863,152	829,379	I.	33,773	4.1
Net	37,774	28,914	I.	8,860	30.8
Chi., Bur. & No.	1,160,146	1,613,351	D.	453,205	28.1
Net	119,123	406,684	D.	287,561	70.7
Georgia Pacific.	795,266	738,000	I.	57,266	7.8
Net	195,949	240,300	D.	44,351	18.4
Mexican National.	1,500,627	1,144,645	I.	355,982	31.1
Net	def. 121,548	144,972	D.	266,520	....
Minn. & St. Louis.	850,125	941,553	D.	91,428	9.6
Net	173,482	235,867	D.	62,385	26.4
Ohio River.	288,092	211,507	I.	76,585	36.2
Net	120,675	92,567	I.	28,108	30.4
Ore. Ry. & Nav. Co.	3,884,183	3,118,060	I.	766,123	24.5
Net	1,300,821	1,223,211	I.	77,610	6.4
Petersburg	290,540	288,198	I.	2,342	.8
Net	99,747	106,046	D.	6,299	5.9
Rich. & Petersburg.	176,371	152,231	I.	24,140	15.8
Net	60,769	68,459	D.	7,690	11.2
Wisconsin Central.	2,389,837	2,354,913	I.	34,924	1.5
Total (gross)	$11,938,370	$11,341,239	I.	$597,131	5.3
Total (net)	2,431,061	3,080,689	D.	649,628	21.1

Nine Months—Jan. 1 to Sept. 30:

Marietta, Col. & No.	$63,695	$49,012	I.	$14,683	30.0
Net	27,211	21,826	I.	5,385	24.7

Three Months—July 1 to Sept. 30:

Nash., Chat. & St. L.	$805,948	$801,506	I.	$4,442	.6
Net	336,968	375,133	D.	38,165	10.2

* Includes three weeks only of September in each year.
† For four weeks ended Sept. 29.
‡ Mexican currency.

The annual report of the Pullman Palace Car Co. for the year ending July 31 is as follows:

	1888.	1887.	1886.
Total earnings	$7,509,754	$6,440,932	$5,623,512
Operating expenses	2,506,534	2,224,807	2,057,627
Paid other companies	1,045,398	1,035,896	868,176
Interest	132,160	159,150	168,050
Repairs	198,870	210,018	.....
Reserve	100,000	.....	100,000
Total expenses	$3,983,262	$3,629,871	$3,193,853
Balance	3,526,492	2,811,061	2,429,659
Dividends	1,510,890	1,274,176	1,274,028
Surplus	$2,015,602	$1,536,885	$1,155,631

The following is a comparison of the earnings and expenses of the Chesapeake & Ohio for the month of September:

	1888.	1887.	Inc. or Dec.	
Gross earnings	$408,889	$415,358	D.	$4,469
Oper. expenses and taxes	252,509	291,871	D.	39,362
Net earnings	$156,379	$123,486	I.	$32,893

Early reports of monthly earnings are usually estimated in part, and are subject to correction by later statements.

Coal.

The coal tonnage for the week ending Oct. 13 is reported as follows, in tons:

	1888.	1887.	Increase.	P.
Anthracite	836,054	693,519	142,535	20.6
Bituminous	349,421	334,374	15,047	4.5

The coal and coke tonnage of the Pennsylvania originating on lines east of Pittsburgh and Erie for the week ending Oct. 6, and the year to that date, was as follows:

	Coal.	Coke.	Total.
Total for week ending Oct. 6	220,440	85,706	306,146
Total for year 1888 to date	8,876,321	3,005,260	11,881,581
Total for year 1887 to date	7,809,730	2,698,427	10,508,157

The anthracite coal tonnage of the Belvidere division of the United Railroads of New Jersey division for the same periods was as follows:

	1888.	1887.	Inc.
Total for week	31,322	22,841	8,481
Total for year	1,246,861	1,213,976	32,885

The Cumberland coal trade for the week ending Oct. 16 amounted to 48,560 tons, and for the year to that date 2,795,433 tons.

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